Vol. XXIX October, 1953 No. 4

THE PAN-PACIFIC ENTOMOLOGIST

EXD.
1954
U.S.A.126

CONTENTS

HUBERT—The biology of Paradixa californica 181
HUBERT—Another species of Rhamphomyia predaceous on mosquitoes 190
SIMONS—New California cicadas with taxonomic notes on other species 191
LOOMIS—A note on Otobius lagophilus 198
RYCKMAN—First report of Paratriatoma hirsuta Barber from Nevada and additional collections from Arizona and California 199
TEVIS—An outbreak of Nymphalis californica near Lake Almanor, California 201
VAN DOESBURG—On some Neotropical Passalidae 203
MALKIN—New records of Arachnida from Alaska 205
GRESSITT—Notes on nomenclature and relationships of some Palearctic and Nearctic Lepturinae 207
HOYT—Deformed abdominal tergites in Musca domestica Linnaeus 208
BARR—Orthezia annae Cockerell found in Idaho 210
TILDEN—The digging and provisioning behavior of Ammophila saeva Smith 211
MALKIN—New Records of Oxyporus from Arizona 218
FIGG-HOBLYN—A new species of Acmaeodera from western Nevada 219
DRAKE & HOBERLANDT—A new species of the genus Angilia from the Philippines, with a catalogue of the described species 223
Book Notices and Reviews 200, 221, 222, 228
Errata for Volume 29 227

SAN FRANCISCO, CALIFORNIA • 1953

Published by the PACIFIC COAST ENTOMOLOGICAL SOCIETY
in cooperation with THE CALIFORNIA ACADEMY OF SCIENCES

THE PAN-PACIFIC ENTOMOLOGIST

EDITORIAL BOARD

E. G. LINSLEY P. D. HURD, JR., H. B. LEECH R. L. USINGER
E. S. ROSS
Co-Editors
R. C. MILLER, *Treasurer* A. E. MICHELBACHER, *Advertising*

Published quarterly in January, April, July, and October with Society Proceedings appearing in the January number. Papers on the systematic and biological phases of entomology are favored, including articles up to ten printed pages on insect taxonomy, morphology, life history, and distribution.

Manuscripts for publication, proof, and all editorial matters should be addressed to H. B. Leech at the California Academy of Sciences, Golden Gate Park, San Francisco 18, Calif., or to P. D. Hurd, Jr., at 112 Agricultural Hall, University of California, Berkeley 4, Calif. All communications regarding non-receipt of numbers, changes of address, requests for sample copies, and all financial communications should be addressed to the treasurer, Dr. R. C. Miller, at the California Academy of Sciences, San Francisco 18, Calif.

Domestic and foreign subscriptions, $4.00 per year in advance. Price for single copies, $1.00. Make checks payable to "Pan-Pacific Entomologist."

BULLETIN OF THE CALIFORNIA INSECT SURVEY

1:1 Middlekauff, W. W. The Horse Flies and Deer Flies of California Pp. 1–24, 1 pl. June 30, 1950 ..... $0.35

1:2 Freeborn, S. B., and R. M. Bohart. The Mosquitoes of California Pp. 25–78, pls. 2–8. June 8, 1951 ..... $0.50

1:3 Linsley, E. G., and J. W. MacSwain. The Rhipiphoridae of California *(Coleoptera)*. Pp. 79–88, pl. 9. June 29, 1951 ..... $0.25

1:4 Hurd, P. D. Jr. The California Velvet Ants of the Genus Dasymutilla Ashmead *(Hymenoptera:Mutillidae)*. Pp. 89–118, pl. 10. August 27, 1951 ..... $0.35

1:5 Hurd, P. D. Jr., and E. G. Linsley. The Melectine Bees of California *(Hymenoptera:Anthophoridae)*. Pp. 119–140, pl. 11, 5 maps. October 31, 1951 ..... $0.25

1:6 Hurd, P. D. Jr. The Scoliidae of California *(Hymenoptera:Aculeata)*. Pp. 141–152, pls. 12 and 13. June 27, 1952 ..... $0.25

2:1 Keifer, H. H. The Eriophyid mites of California *(Acarina:Eriophyidae)*. Pp. 1–128, pls. 1–39. December 12, 1952 ..... $2.00

2:2 Pritchard, A. Earl The Gall midges of California *(Diptera: Itonididae* olim *Cecidomyiidae)*. Pp. 125–150, pl. 40. February 27, 1953 ..... $0.35

Send orders to: UNIVERSITY OF CALIFORNIA PRESS, BERKELEY 4

Entered as second class matter, February 10, 1925, at the post office at San Francisco, under act of August 24, 1912.

The Pan-Pacific Entomologist

VOL. XXIX, No. 4 October, 1953

THE BIOLOGY OF PARADIXA CALIFORNICA

(Diptera: Dixidae)[1]

ALEXANDER A. HUBERT

University of California, Berkeley[2]

This study was made to help fill the need for investigations of the biologies of individual species of the family Dixidae. *Paradixa californica* (Johannsen) was selected because an excellent breeding site was discovered on the University of California campus, where this research was done. Several artificial pools in a courtyard provided all of the ecological factors essential for the support of a large population. Specimens were also collected from numerous creeks and ponds elsewhere in the San Francisco Bay region.

In this paper, after a listing of distribution records for the species, the different stages in the life cycle are discussed, starting with the adult and ending with the pupa. A separate section on methods is not included, because most of the techniques employed are either standard practice in the study of mosquitoes or were mentioned in a recent paper by Nowell (1951).

DISTRIBUTION

In his original description, Johannsen (1923) recorded the type locality of this species as Stanford University, California. Garrett (1924) mentions that two variations of the species occur in British Columbia. About half of the locality records listed below are based upon specimens in the California Academy of Sciences collection (C.A.S.). The remainder of the specimens were collected by the writer, or his associates at the University of California.

CALIFORNIA RECORDS. *Alameda County:* Berkeley, V-23-15 (M. C. Van Duzee) C.A.S.; IV-24-51 (F. Mok); 1950-51 (A. A. Hubert). Castro Valley, IV-10-39 (T. H. G. Aitken) C.A.S. Pleasanton, XI-22-39 (T. H. G. Aitken) C.A.S. *Contra Costa County:* 5 mi. W. Moraga, VI-17-51 (A. A.

[1] Extract from a thesis submitted in partial fulfillment of the requirements of the degree of Master of Science in Entomology in the Graduate School of the University of California.

[2] Present address Rocky Mountain Laboratory, Hamilton, Montana.

Hubert). *Marin County:* 8 mi S.W. Fairfax, IV-22-51 (C. J. Weinman); VI-23-51 (A. A. Hubert). 2 mi. W. Lagunitas, V-19-51 (C. J. Weinman). Mill Valley, IX-11-45 (E. L. Kessel) C.A.S. Muir Woods Nat. Mon., V-19-15 (M. C. Van Duzee) C.A.S. 2 mi. N. Pt. Reyes Station, V-19-51 (C. J. Weinman). *Mendocino County:* 14 mi. W. Willits, VI-30-51 (W. C. Bentinck). *Monterey County:* Carmel, VII-7-40 (T. H. G. Aitken) C.A.S. Del Monte, X-19-39 (T. H. G. Aitken) C.A.S. *San Mateo County:* San Mateo, IV-42 (E. S. Ross) C.A.S. *San Francisco County:* San Francisco, III-25-26 (M. C. Van Duzee) C.A.S. *Santa Clara County:* Stanford University, 1923? (O. A. Johannsen?); III-29-41 (T. H. G. Aitken) C.A.S. *Sonoma County:* Occidental, IV-22-51 (A. A. Hubert). 3 mi. N. Valley Ford, VII-14-51 (C. J. Weinman).

BRITISH COLUMBIA RECORDS. 1924? (C. B. D. Garrett.)

THE ADULT

General Habits. The adults of this species do not seem to differ in their general habits from those of other kinds of dixids observed. They prefer to rest head upward in places close to the water that are shaded, cool, and moist. On rock surfaces they are found from a few inches to three feet above the water. In the artificial pool, where many observations were made, they were noticed to congregate in the corners. It was also in these corners that most of the egg masses were found. Adults were frequently captured in hollows beneath dirt banks among the roots of plants. In steep seepage areas they will rest on the thick wet moss. The only time when this species was observed to rest on the leaves of shrubs was in the evening. Dixidae seem to undergo a daily migration from the moister and more sheltered niches close to the stream in the middle of the day, to the overhanging or bordering vegetation in the cool of the evening.

Very little time during the daylight hours is spent in actual flight. The flights, when they do occur, are low and of short duration. When *P. californica* adults are disturbed, they fly a short distance along the bank and land again. At times they will fly out from the bank and return almost to the exact spot which they left. An individual will often hover at several places along the margin of a stream or pool before choosing a resting place.

The Question of Feeding.—It has been generally accepted that adults of the family Dixidae do not feed. This deduction has been based principally upon the poorly developed mouthparts, which are evidently not adapted for biting. However, Malloch (1917) reported that he found adults on flowers, apparently feeding on

nectar. Montschadsky (1936), in contrasting the Dixidae with the Culicidae, claimed that the former are plant feeders.

Adults of *Paradixa californica*, kept in an insect cage, were observed to land on some apple slices and go through the motions of feeding. Each apparently feeding individual crouched with its body tilted at a slight angle to the apple and brought its mouthparts in contact with the moist surface. It seemed to feed on one spot for a while, and then spend some time exploring and probing with its proboscis. However, all motions of the latter sort were barely perceptible to the unaided eye. On another occasion a female was seen while evidently attempting to feed on a dried out slice of apple. A bowl of water was kept in the cage at all times.

During the summer of 1951 a number of females were seen in the typical feeding or drinking attitude on the bank of one of the artificial pools previously mentioned. Most of these were on damp areas of the concrete bank, but one was crouched where the bank was dry. The flies would maintain this position for several minutes at a time, and no motion could be detected. These observations were made during daylight.

The most plausible explanation for this behavior is that the dixids are seeking moisture. However, the proximity of water in all cases, and the apparent restriction of this habit to females, indicate that they might actually be feeding. In any case, feeding is not essential, because adults will mate, oviposit, and live as many as fifteen days without taking any nourishment.

Longevity.—Previous estimates of the length of dixid adult life fell far short of the averages recorded for *Paradixa californica.* For example, Nowell (1951) stated that adult dixids usually live two to three days. The over-all average for 16 individuals timed by the writer was nine and one-half days. All specimens lived at least four days, and the maximum time recorded was 15 days. On the average the females lived slightly longer than the males. In order to obtain the above figures, pupae were reared in individual vials, and the dates that the adult emerged and died were noted. In each vial was a wad of cotton moistened with water, but no food material. Most of the vials were kept in the laboratory at an average temperature of 70.8 degrees Fahrenheit. A cooler environment lengthened the life expectancy.

Mating Habits.—There are two distinct patterns in the mating procedure of *Paradixa californica.* In one of them no swarming of

the males takes place, and mating occurs during daylight. The other involves swarming flights and takes place in the evening. The swarming of dixid males has been mentioned many times in the literature, but the other pattern has not been previously reported.

Although mating of the first type can occur during any kind of weather, it is most often seen on cool overcast days. The first case of this kind was observed on the bank of the artificial pool in April, 1951. Others were seen throughout the remainder of spring and summer. On most such occasions the adults engage in short individual flights along the bank and do a considerable amount of hovering. The males are slightly more active in this respect than the females.

In mating a male flies over to a resting female and half flies, half climbs onto her back. Mounting results in the male facing in the same direction as the female. The male next climbs backward over the larger female and gropes for the tip of the abdomen with his terminalia. While continuing in his attempts to bring the genitalia together, he climbs over the side of the female and underneath, until he is suspended below her body in an inverted position. Union of the copulatory organs occurs in this position. Usually the female raises her hind legs, enabling the male to pass under more easily. Actual copulation lasts from a few seconds to several minutes.

The writer was not fortunate enough to witness any swarming flights until a still evening in June, when several separate swarms were seen. The adults had congregated on the undersides of the leaves of a large bush on the bank of the pool. Several males would begin flying opposite the end of a branch until seven or eight individuals were swarming in a rather tight formation. The flight of each consisted of a constant rising and falling with a change in elevation of about three inches. Very little horizontal distance was covered in these maneuvers. No actual copulations were seen, although several couples paired off for a few seconds. From time to time adults of either sex would drop out of the formation and land on the lower side of a leaf.

Nowell (1951) records that female dixids fly down through the center of a swarm, become paired with males, and the fused couples settle on leaves or rocks below. He states that copulation is com-

pleted in about a minute, and then the males fly back up into the swarm.

Oviposition.—When ready to oviposit, the female *Paradixa californica* locates a rock, or other suitable substratum with a moist surface. Sheltered corners or areas hidden by plants are preferred to unprotected spaces. The gravid female comes to rest at a point about an inch above the surface of the water, and her abdomen begins a series of pulsations, each one of which carries the tip closer to the substratum. Soon after the tip has made contact, the first white eggs appear and are attached to the bank by the gelatinous substance in which they are enclosed. Laying of the entire egg mass takes about half an hour.

Little difficulty is encountered in inducing females to oviposit in captivity. A bowl with a small amount of water and an emergent rock for the attachment of egg masses are all that is necessary. Oviposition can occur within five days after mating.

THE EGG

Development.—Each egg consists of an elliptical white central

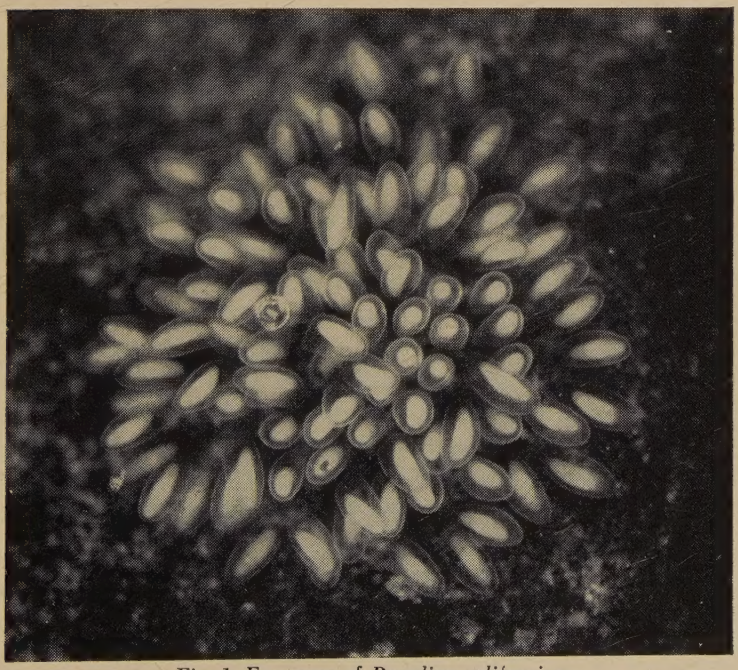

Fig. 1. Egg mass of *Paradixa californica*

portion surrounded by a more transparent capsule. These eggs are imbedded in a perfectly clear gelatinous mass, which is attached to a rock or floating branch at, or a short distance above the water-line. As the partially submerged mass matures the gelatinous matrix tends to disintegrate, and some eggs may even become free and sink to the bottom. By the fourth or fifth day after oviposition, larvae can distinctly be seen within the eggs. The head can be distinguished from the rest of the body, which is bent back on itself. The extremities may be directed toward either end of the egg. The eyes, prothoracic setae, and caudal bristles are visible.

A few hours before the eggs are ready to hatch, the larvae may be seen to move and reverse position within their egg capsules, which gradually weaken and become quite flaccid. The activity of the larvae increases until they are turning and twisting with great vigor. Emergence is achieved by thrusting repeatedly against the weakening apex of the egg with either end of the body or the middle loop, until a rupture is finally forced. The larva may come forth in any position, depending on when the retaining membrane gives way.

The maximum number of eggs counted in any mass was 100 and the minimum was 42. The average for six egg masses was 75 eggs. The egg stage average five days in length at room temperature. No significant difference was noted at a temperature ten degrees cooler.

Ability to Withstand Desiccation.—A chip of wood having several attached egg masses in various stages of development was removed from the water and placed in an empty bowl. For two days the wood was kept only slightly damp, and for three more days it and its egg masses were allowed to desiccate completely. At the end of this period the egg masses had become reduced to some stained areas on the dry wood. The chip was placed in a bowl of water, and at once the water was literally covered with hundreds of wriggling first instar larvae. Apparently development continued to an advanced stage despite the five days that the eggs were out of water.

Further evidence that at least a certain amount of desiccation might not be abnormal in the development of the eggs of this species was derived from an examination of masses along the bank of the pool where most of these studies were made. The masses

varied in height from half an inch to fully two inches above the water surface. Most of these were on damp areas, but others were apparently isolated by recession of the water. Fluctuations in the level of the pool take place periodically, and many of the eggs laid undergo this drying before they are inundated by a subsequent rise in the water level. Admittedly this is an artificial situation, but this adaptation must also aid in the survival of the species under more natural conditions.

THE LARVA

General Characteristics.—The larvae of *Paradixa californica* may be found along the margins of slowly flowing creeks, and in small ponds and pools, both natural and artificial. They assume the usual dixid position on a moist surface with the middle of the body looped away from the water, and both head and posterior end in the positive meniscus. Rocks and floating branches are the favorite resting places, but occasionally larvae will crawl up on emergent vegetation. Shade is always preferred to sunlight.

Although the larvae require an aquatic environment, they do not hesitate to crawl up out of the water on the moist surface of a rock or plant stem. Comstock (1924) best characterized the typical dixid method of terrestrial locomotion when he reported that larvae progress by alternate thrusts of the two ends of the body, the bent portion travelling foremost. The larvae of *californica* have paired prolegs on the first and second abdominal segments, and a series of ambulacral combs on the fifth through seventh abdominal segments, which alternately provide an anchorage enabling the opposite side of the body to advance. At all times the larvae are covered with a thin film of water. This not only provides protection against desiccation, but it supplies them with a smooth wet surface on which to slide.

The larvae of this species swim awkwardly and rather slowly. The anterior half of the body swings forcefully to one side, the bend occurring at about the fourth abdominal segment, and the posterior half also moves to the same side. Then the process is reversed, the middle loop exchanging sides with both ends of the body.

The various instars feed exclusively on material floating in the surface film of water. The head is tilted back until it is almost ventral side up, and a current created by the labral and maxillary mouth brushes conveys all small particles to the mouth. Everything

is taken into the mouth, but the larva lowers its head to a horizontal position and egests larger pieces of inorganic material.

Reactions to Stimuli.—When disturbed, a larva on a wet rock surface will crawl away from the source of irritation with one or two quick thrusts of the body. If teased with a brush from the direction of the water, it will move up the rock until the stimulus is discontinued. Similarly, if prodded from above, it can be induced to reverse the direction of its body loop in one motion and swim out from the rock.

A sudden bump against the container, or a prod with the brush, will sometimes cause a swimming or floating larva to thrust itself away from the surface film and sink down a short distance. If the water is shallow, it will lie motionless on the bottom with its body bent. It will swim back up to the surface after a few seconds if the stimulus is not repeated. The spiracular lobes and lateral lobes of the caudal end are folded inward holding a bubble of air over the spiracles during these dives. This escape mechanism enables the larvae to elude predators at the water surface.

Parasites and Predators.—Since Nowell (1951) discussed the enemies of dixid larvae at some length, this account will be limited to the writer's experience regarding *Paradixa californica.* A hydrophilid larva of the genus *Tropisternus*, which was collected with some dixids of this species, had captured one of the latter when taken. Another *Tropisternus* kept in a bowl of water was observed to capture and eat a larva.

Some larvae being reared by the writer became infected about the anal area with what appeared to be a fungus. Dr. E. A. Steinhaus, insect pathologist at the University of California, was kind enough to examine the infected specimens. His findings showed the presence of large numbers of rod-shaped bacteria gathered about the caudal end of the larvae. Cultures of the gelatinous mass of bacteria yielded abundant growth of a gram-negative short rod that did not ferment lactose. A gram-negative yellow pigmented rod (probably a *Flavobacterium*) was also present, but this was believed to be an adventitious species. No fungi were apparent either on the larval specimens or the culture plates.

Rate of Development.—The length of the different instars was determined by rearing the larvae from the egg stage. It was necessary to collect third instar larvae and rear the fourth instars individually after they molted, due to the high mortality and slow

development. Most of the rearing was done either outside or in the laboratory in finger bowls containing pond water. The water was changed frequently to prevent the development of bacteria and to introduce a fresh supply of food. The over-all average length of the first instar was six and one-half days, of the second instar 10 days, of the third instar 13 days, and of the fourth instar 33 days. The average length of 63 days thus computed for the larval stage is undoubtedly much longer than would be the case in the natural habitat. If the minimum times for each of the four instars are totalled a length of 43 days is obtained.

THE PUPA

The larvae of *Paradixa californica* always climb up out of the water to pupate. Most pupae are found attached by their side to the substratum a short distance above the surface of the water. They remain in this position, with the abdomen tightly curled about the cephalothorax, until the emergence of the adult. If they are loosened accidentally by the current, they will float in the water dorsal side up with the respiratory trumpets breaking the surface. Emergence of the adult will take place whether the pupa is attached to the bank or is in the water. However, the newly-emerged adult is very fragile and is easily drowned.

A pupa that has recently shed its last larval skin still retains a limited motility. The abdomen is not so firmly appressed to the cephalothorax and can be used in crawling. An early pupa on a wet rock surface can be induced to crawl away from a point of irritation with surprising rapidity. It does so by straightening and curling the abdomen. In this early stage the pupa can also right itself in the water. The inability to move, which develops later, is due to a hardening of the pupal skin.

Of all the stages in the life cycle, the length of the pupal stage is the mot constant. In the laboratory it almost invariably lasted three days. Four days was the longest time recorded.

ACKNOWLEDGMENTS. The writer wishes to acknowledge his indebtedness to Dr. R. L. Usinger, who suggested the problem and helped immeasurably during the course of this study. Thanks are due Dr. E. A. Steinhaus for the examination of bacteria infecting the larvae. Acknowledgment is made of the help rendered by W. C. Bentinck, C. D. MacNeill, and C. J. Weinman in collecting dixid material. Dr. H. Dietrich, of Cornell University, was kind enough to lend the writer the holotype of *Paradixa californica* for com-

parison with the material being studied. Dr. C. D. Michener, of the University of Kansas, was very helpful in the final preparation of this paper for publication.

LITERATURE CITED

COMSTOCK, J. H.
1924. A manual for the Study of Insects. New York: Comstock Publishing Co. (p. 295.)

GARRETT, C. B. D.
1924. New American Dixidae. [Cranbrook, B. C.] 7 pp.

JOHANNSEN, O. A.
1923. North American Dixidae. Psyche, 30:52–58.

MALLOCH, J. R.
1917. A preliminary classification of Diptera exclusive of Pupipara. Bulletin Illinois State Laboratory of Natural History, 12:161–411.

MONTSCHADSKY, A. C.
1936. Tableaux analytiques de la faune de l'URSS. Moscow. (pp. 89–98.)

NOWELL, W. R.
1951. The dipterous family Dixidae in western North America (Insecta: Diptera). Microentomology, 16:187–270.

ANOTHER SPECIES OF RHAMPHOMYIA PREDACEOUS ON MOSQUITOES (Diptera: Empididae)[1] A species of *Rhamphomyia* was reported by Frohne (1952. Mosquito News, 12 [4]:263) as being a water-level predator of emerging mosquitoes in Alaska. The flies were said to be of small size, and the wings were described as "smoky." Both sexes were assumed to be predaceous. In July, 1952, some medium-sized empidids with similar predatory habits were collected by the writer in the Bitterroot Mountains of southwestern Montana. These flies, which have clear wings and are evidently a different species from those observed by Frohne, were tentatively identified by Mr. G. E. Shewell of the Canadian Department of Agriculture, Ottawa, as *Rhamphomyia (Megacyttarus) argenteus* Bigot. They were observed flying back and forth at a height of six to twelve inches above sunlit alpine pools, frequently darting to the surface of the water to capture pupae and newly emerged adult mosquitoes. Small bits of twig and other floating particles were struck in flight and immediately released. All specimens in a small series collected at each of two sites were males. In one place the mosquitoes being preyed upon were *Aedes nearcticus* Dyar and *Aedes hexodontus* Dyar; in another they were a species of *Culiseta*. The elevations of these localities were 7,500 feet and 8,300 feet respectively.—ALEXANDER A. HUBERT, Rocky Mountain Laboratory, Hamilton, Montana.

[1] From the Federal Security Agency, Public Health Service, National Institutes of Health, National Microbiological Institute.

NEW CALIFORNIA CICADAS WITH TAXONOMIC NOTES ON OTHER SPECIES

(Homoptera: Cicadidae)

John N. Simons

University of California, Berkeley

California has probably the largest cicada fauna of any area of comparable size in the United States. Of the eight genera present, *Okanagana* with 36 species and *Platypedia* with 18 species are the most abundantly represented.

Recent collections by the author have uncovered an apparently new species of *Okanagana*. In addition three new species of the genus *Platypedia* have been found. Specimens of the latter were part of a large collection of cicadas given by Mr. F. H. Wymore to the California Academy of Sciences several years ago.

Okanagana davisi Simons, new species

Male: Head black above, much covered with appressed silvery pubescence, as broad as anterior margin of pronotum. *Pronotum* black, with much silvery pubescence, hind margin with faint edge of pale orange. Mesonotum black, four median orange spots arranged in a semicircle, the X marked anteriorly with orange to form a V, hind margin edged faintly with orange. Metanotum black, hind margin edged faintly with orange. *Abdomen* black above, each tergite with much silvery pubescence and margined laterally very faintly with orange; beneath, each sternite pale orange; laterally the pleurites orange but marked centrally with black. *Aedeagus* black; valve orange marked with black laterally (fig. 1A). *Legs* black; front femora with median dorsal spot of chestnut, tips pale orange. Thorax beneath black with much silvery pubescence. *Forewings*, costa to node pale yellowish, node to apex black, remaining venation mostly black. Membranes of fore and hind wings orange-red, variegated with black.

Measurements: body length 25 mm., wing expanse 63 mm.

Holotype (California Academy of Sciences, San Francisco): Mattole River Valley, Honeydew, Humboldt Co., California, June 20, 1950 (J. N. Simons). *Paratypes:* 7♂♂, same data as type; 1♂, Van Duzen River, Humboldt Co., California, August 11, 1948 (W. W. Wirth).

O. davisi is closely allied to both *O. canescens* Van Duzee and *O. tristis* Van Duzee. It can be separated from the former on the basis of 1) the silvery pubescence on the notum as opposed to the sparser and more golden pubescence found in *O. canescens*, and 2) the hind margin of the pronotum being very faintly edged with orange while in *canescens* this margin is conspicuously

orange. From *O. tristis* this species can be separated on 1) its silvery pubescent notum contrasted with the almost glabrous notum of *O. tristis*, 2) the entirely pale abdominal sternites which in *O. tristis* are usually blackened laterally, though at times they may be completely pale, and 3) the aedeagus in profile view (fig. 1A) having the lower surface bent upward in the apical fourth while in *O. tristis* this line is turned up in the apical third.

This species is named after the late William T. Davis, the most important single contributor to the knowledge of Cicadidae of North America.

Platypedia usingeri Simons, new species

Male: Head black above, almost glabrous, the supra-antennal plates edged with pale orange. *Pronotum* not hairy, black except for the following pale orange markings: narrowly on the anterior margin, median sulcus, and broadly on the hind margin. Mesonotum not hairy, black except for hind margin which is pale. Metanotum black edged with pale color. *Abdomen* black above, each tergite with much silvery pubescence; beneath, each sternite black, covered with short silvery hairs, especially towards the pleurites. *Aedeagus* black; valve black (fig. 1B). *Legs* mostly pale except for front femora which are chestnut. *Forewings*, costa to node pale yellowish, venation except for darker marginal cells mostly pale yellowish. Membranes of fore and hind wings yellowish-white to white.

Measurements: body length 20 mm., wing expanse 39 mm., width of forewing 7 mm., length of forewing 17.5 mm., length of valve 5 mm.

Female: Same as for male with the exception of the genitalia.

Measurements: body length 17 mm., wing expanse 44 mm., width of forewing 7 mm., length of forewing 19.5 mm.

Holotype male and *allotype* female (California Academy of Sciences, San Francisco): PUTAH CANYON, YOLO–SOLANO Co's., CALIFORNIA, May 7, 1929 (F. H. Wymore). *Paratypes:* 3♂♂. same data as for holotype.

This species appears to be closely related to *P. scotti* Davis, *P. mariposa* Davis, and *P. middlekauffi* n.sp. The author has not been able to identify females of these three species, but the characteristic shape of the aedeagus of the male separates *P. usingeri* from males of the above species. In *P. scotti* the aedeagus is slightly notched apically in dorsal view and in profile it turns up distally. In *P. mariposa* the aedeagus is smoothly arched on top, not sinuate as here, and rather concave on the bottom surface retaining only the subapical sinuation of *P. usingeri*. From *P. middlekauffi* it is distinguished primarily by the smoothly arched upper surface of the aedeagus (fig. 1D).

Platypedia sylvesteri Simons, new species

Male: Head black above, with a few short black hairs, supra-antennal plates margined with orange. *Pronotum* black except for the following orange areas: narrowly on the anterior margin, median sulcus, and broadly on the posterior margin. Mesonotum black, hind margin pale orange, the areas about the mesonotal X with many silvery hairs. Metanotum black, hind margin pale orange. *Abdomen* black above, the tergites, especially on the sides, covered with silvery pubescence; black beneath, densely covered with silvery pubescence and hairs. *Aedeagus* black; valve brownish (fig. 1C). Front *legs*, femora dark chestnut, black beneath, tibiae black in proximal two-thirds, pale distally; middle and hind legs pale, striped with black. *Forewings*, costa to note pale yellow, venation black; hind wings with venation mostly pale except for darker marginal cells. Membranes of fore and hind wings pale orange.

Measurements: body length 20 mm., wing expanse 47 mm., width of forewing 9 mm., length of forewing 20 mm., length of valve 4.5 mm.

Holotype (California Academy of Sciences, San Francisco): PANAMINT MTNS., INYO CO., CALIFORNIA, May 29, 1937 (Thorndike). *Paratype:* 1♂, same data.

Two other species of *Platypedia* having orange basal wing membranes and broad forewings (ratio of width to length 1:2) have been described. They are *P. barbata* Davis and *P. vanduzeei* Davis.

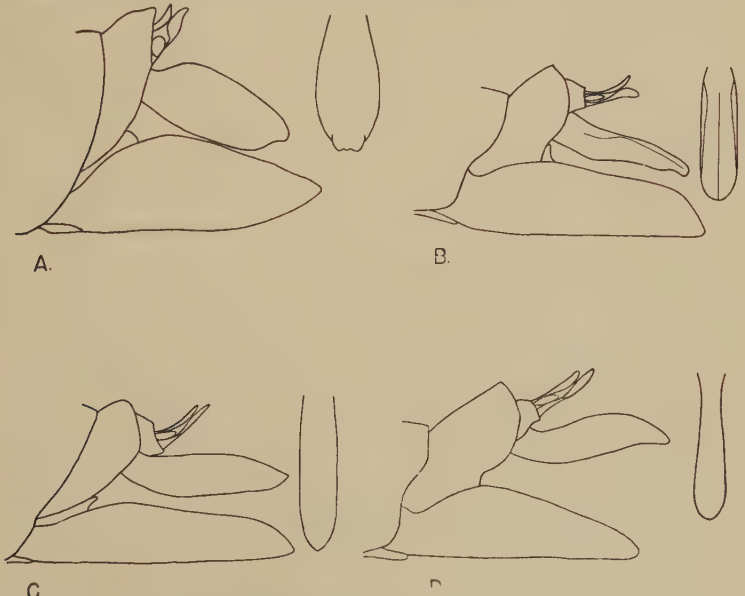

Fig. 1. Lateral (left) and dorsal (right) aspects of the aedeagi of the following species. A. *Okanagana davisi* Simons; B. *Platypedia usingeri* Simons; C. *P. sylvesteri* Simons; D. *P. middlekauffi* Simons.

P. sylvesteri differs from *P. barbata* in not having a densely hairy head, and in having a differently shaped aedeagus. In *P. barbata* the aedeagus is concave on the lower surface and bent down slightly in the apical third. From *P. vanduzeei* this species can be separated on the basis of the hairiness of the head and in differences in the aedeagus. The aedeagus of *vanduzeei* in profile is sharply upturned in the distal two-thirds of its length.

Platypedia middlekauffi Simons, new species

Male: Head above black, almost glabrous, the supra-antennal plates pale orange. *Pronotum* glabrous, mostly pale orange except for a horizontal line paralleling and just anterior to the hind margin and several longitudinal lines which are black. Mesonotum black, the hind margin orange, a few short silvery hairs near the X. Metanotum black, the hind margin orange. *Abdomen* black above, sparsely covered with silvery pubescence; black beneath, with a few silvery hairs. *Aedeagus* black; valve black, with a few short hairs posteriorly. (fig. 1D). *Legs* almost entirely pale except for front femora which are chestnut. *Forewings*, costa to node, pale yellow, venation except for dark marginal cells also pale yellow; hind wings with venation mostly pale. Membranes at base of fore and hind wings pale yellowish.

Measurements: body length 19 mm., wing expanse 42 mm., width of forewing 6 mm., length of forewing 19 mm., valve length 4.5 mm.

Female: Same as for male with the exception of the genitalia.

Measurements: body length 17 mm., wing expanse 44 mm., width of forewing 6.5 mm., length of forewing 20 mm.

Holotype male and *allotype* female (California Academy of Sciences, San Francisco): AUBURN, PLACER CO., CALIFORNIA, June 11, 1929 (F. H. Wymore). *Paratypes:* 2♂♂, 2 ♀♀, same data.

This species appears to be unique in having the pronotum mostly pale orange in color. However, several specimens taken in the same locality by Mr. Wymore, although agreeing structurally in all other details with the type, do not have the orange pronotum. These would fall next to *P. similis* Davis but can be separated from this species on the basis of 1) the hind margin of the pronotum of *similis* being broadly pale yellow while in *P. middlekauffi* it is only faintly edged with chestnut, 2) the aedeagus of *P. similis* in profile is very straight on the distal three-fourths of the lower surface except for a subapical sinuation while in *middlekauffi* this surface bends downward at this point. It is not possible to separate females of *P. scotti* Davis, *P. mariposa* Davis, and *P. usingeri* n.sp. at this time. Characters of the aedeagi of these species are discussed following the description of *P. usingeri.*

Platypedia putnami (Uhler)

Three color varieties of *Platypedia putnami* (Uhler), varieties

keddiensis, *occidentalis*, and *lutea*, were described by Davis[1]. Subsequently he elevated all of these forms to full species standing. This was done primarily on the basis of differences in distribution of the several forms. Actually *P. lutea* and *P. putnami* now appear to be almost sympatric in distribution, with only slight color differences separating them. In view of this the author proposes 1) to place the name *lutea* in synonymy, *putnami* (Uhler) having priority over *lutea* Davis, and 2) to shift *keddiensis* Davis and *occidentalis* Davis into infraspecific standing along with *putnami* (Uhler).

The known distributions of the forms are listed below and also indicated in fig. 2.

1. *P. putnami putnami* (Uhler). Ariz., Calif., Colo., Nebr., Nev., N. Mex., and Utah.

   P. lutea Davis. Ariz., Calif., Mont., Nev., S. Dak., Utah, and Wyo.
2. *P. putnami keddiensis* Davis. Calif., and Ore.
3. *P. putnami occidentalis* Davis. Calif.

Platypedia bernardoensis Simons, new combination

At the time W. T. Davis described *Platypedia rufipes* var. *bernardoensis* and *P. rufipes* var. *angustipennis*[2] it was suggested that they might be specifically different from *P. rufipes*. To the author it appears that *bernardoensis*, which differs from *rufipes* in the shape of the aedeagus, the coloration of the venation of the forewing, and in being a larger insect, is a different species. He also feels that var. *angustipennis* which is differentiated from *bernardoensis* on the basis of minor color differences is synonymous with that species.

Color Variation in California Cicadas

Several genera of California cicadas have been reported to have species which display considerable variation in coloration, this variation generally being expressed as a non-pigmented or pallid type of individual. The genera involved are *Diceropracta* Stål (*D. apache* Davis and var. *ochraleuca* Davis), *Okanagodes* Davis (*O. gracilis* Davis and var. *pallida* Davis), *Clidophleps* Van Duzee (*C. distanti* Van Duzee and var. *pallida* Van Duzee), and *Okanagana* Distant (*O. triangulata* Davis and var. *crocina* Wymore, *O. arboraria* Wymore and var. *crocea* Wymore, and *O. rub-*

[1] Davis, W. T., 1920. North American Cicadas belonging to the genera **Platypedia** and **Melampsalta**. Jour. New York Ent. Soc., 28:106-109.

[2] Davis, W. T., 1932. Additional records of North American cicadas with descriptions of new species. Jour. New York Ent. Soc., 40:259-260.

rovenosa Davis and var. *rubida* Davis). *Okanagana vanduzeei* Distant has had two partially pigmented forms, var. *consobrina* Distant and var. *californica* Distant described. In *O. pallidula* Davis this variation from predominately dark specimens to lighter col-

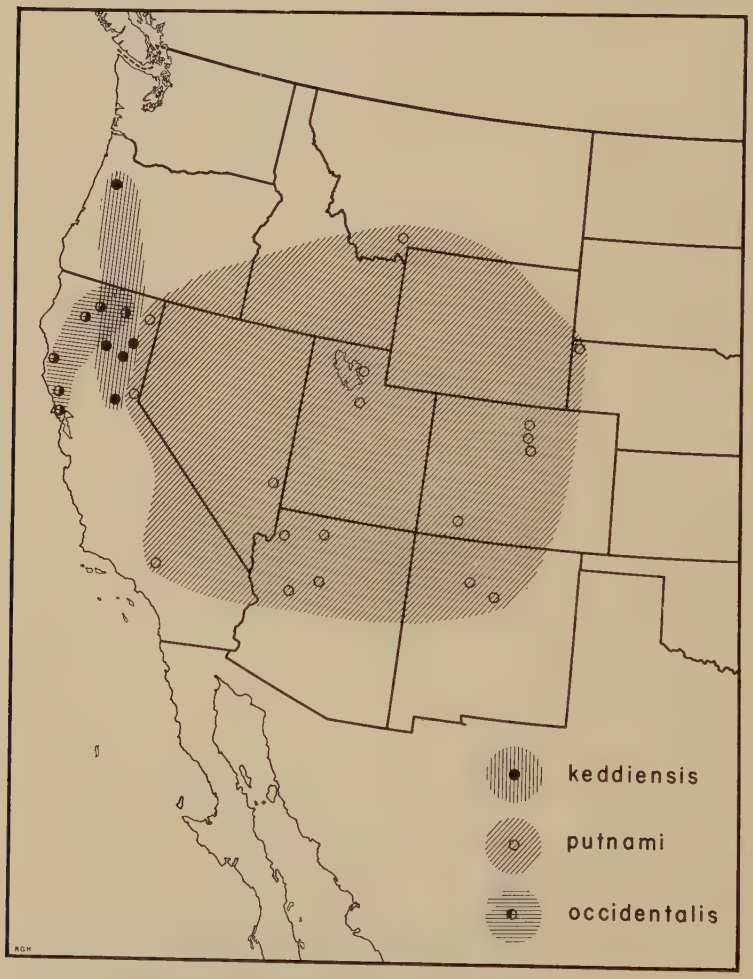

Fig. 2. Distribution of *Platypedia putnami* (Uhler).

ored forms is reversed with the pale specimens being much more common than the darker var. *nigra Davis.*

Recently a series of 19 entirely pale male *O. vanduzeei* Distant were taken near Lake Curry, Napa Co., Calif. In addition to these

specimens 42 *O. vanduzeei* var. *consobrina* Distant (var. *californica* Distant) males and two typically black *O. vanduzeei* Distant males were captured. Previous collections of this species in the San Francisco Bay area had indicated that the ratio of dark forms to the intermediate *consobrina* type was about two to one.

Since the major effort in collecting the Lake Curry population was directed toward first taking the pale forms and later in obtaining the typical *vanduzeei* no claim can be made for a random sample of the population. In addition it should be pointed out that observations of the population indicated that air temperature seemed to exert some influence as to whether the pale or intermediate forms were singing. No records of the actual temperature were made but most specimens of the pallid form were taken between 10:00 A.M. and 11:00 A.M. and as the temperature increased more and more *consobrina* were caught. Since collections were generally made over a period of several hours the tendency to acquire a biased sample was somewhat lessened. However, the observation certainly illustrates one complicating factor in the taking of a truly random sample of such a heterogeneous population.

Additional specimens of this pale form, ranging in distribution from Humboldt Co., Calif. to Inyo Co., Calif. have also been observed in the collection of the California Academy of Sciences.

Another species which exhibits this same variability in color and in which it has not been previously reported is *Okanagana utahensis* Davis. In the collection of the California Academy of Sciences there is a long series of pale examples of this species as well as several typically dark individuals taken by Mr. F. H. Wymore at Davis, Solano Co., Calif. In addition one specimen from Kings Co., Calif. has been seen. So far no records of either this form or the pale form of *O. vanduzeei* have been seen from outside of California, but it would be rather surprising if these cases are restricted geographically, in view of the seemingly sympatric distributions of the other species discussed here. For the present the author will regard all the color forms discussed here as being within-population variants and therefore proposes that the use of varietal names be discontinued for these categories until more positive evidence that infraspecific groups are being dealt with is found.

There are at least two hypotheses which might be proposed to explain color variation in cicadas: 1) a mutation from the dark

to the pale form which has since perpetuated itself, and 2) the expression of genetic factors, possibly multiple recessive in nature. Evidence for the former might be found in the case of *Okanagodes gracilis* Davis where oftentimes the entire sample of a population will be pale. The differences in observed ratios of numbers of dark, intermediate, and pallid individuals of populations of *O. vanduzeei* Distant however could probably be better explained on the basis of the expression of recessive genetic factors. Unfortunately cicadas do not lend themselves to the type of experimental work which it would be necessary to employ in order to work out a solution to this problem.

A NOTE ON OTOBIUS LAGOPHILUS (ACARINA:ARGASIDAE)

This brief note contributes a new locality record of the tick *Otobius lagophilus* Cooley and Kohls, in California. Over 200 unfed larvae and five females of this species were collected from the immediate entrance to an active rodent burrow in Lonetree Canyon near Tracy, San Joaquin County, California, in August, 1951. This burrow was one of several which were dispersed some five to ten feet above the canyon floor in sandstone cliffs. The location was approximately five miles equidistant from a sheep ranch to the east and a cattle ranch to the northwest. Fresh droppings from sheep, cattle, and various rodents were in evidence in the immediate vicinity.

Upon returning to this area in June, 1952, 13 males, 11 females and two cast nymphal skins were recovered. Four specimens were taken from the original site of the 1951 collection and 20 specimens plus the two nymphal skins were taken from the fine sand underneath an old watering trough in the center of the canyon floor. One male *Sylvilagus bachmani* (Waterhouse) was shot immediately south of this area but upon examination proved negative for *O. lagophilus*.

The only other published California record of this species of tick is an account of 17 nymphs taken around Barstow, San Bernardino County in 1924. Other records on the collection of this species are from Alberta, Canada; Colorado, Idaho, Montana, Nevada, Oregon and Wyoming.[1]

These ticks are uually associated with members of the Lagomorpha, namely, species of *Lepus* and *Sylvilagus*. They have also been recorded once from a cat and also once from inside rodent burrows. Such a collection extends the known distribution of this species in California and lends further support to the belief that many small rodents may play a more significant role as a host animal than heretofore suspected.—EDMOND C. LOOMIS, Bureau of Vector Control, 2180 Milvia St., Berkeley 4, Calif.

[1] Cooley, R. A. and G. M. Kohls. 1944. The Argasidae of North America, Central America and Cuba. Amer. Midland Nat., Monograph No. 1.

FIRST REPORT OF PARATRIATOMA HIRSUTA BARBER FROM NEVADA AND ADDITIONAL COLLECTIONS FROM ARIZONA AND CALIFORNIA[1]

(Hemiptera: Reduviidae)

RAYMOND E. RYCKMAN

Department of Entomology, School of Tropical and Preventive Medicine, Loma Linda, California

On June 4, 1953, six nests of *Neotoma* sp., 16 miles north of Searchlight, Clark County, Nevada, were examined. These wood-rat nests were all built in and around the base of *Yucca*. Of the six nests examined three contained *Paratriatoma hirsuta* Barber, as follows: Nest No. I, one 4th instar; Nest No. II, three 5th instars and six adults; Nest No. III, two 4th instars, one 5th instar and 15 adults. The above collections were made by the author assisted by R. D. Lee, C. C. Lindt, C. T. Ames and C. P. Christianson.

During the past three years the following additional collections of *P. hirsuta* have been made in Arizona and California.

Twenty miles south of Mesa, Pinal County, Arizona, April 14, 1952, (R. E. Ryckman and K. Y. Arakawa). Specimens collected, one 3rd instar, one 4th instar and nineteen 5th instars.

Seven miles east of Desert Center, Riverside County, California, November 28, 1950 (R. E. Rychman).

Marquitta Mine, east of Quartzsite, Yuma County, Arizona, November 28, 1950 (R. E. Ryckman).

Lucerne Valley, 18 miles southeast of Victorville, San Bernardino County, California, July 13, 1953, (R. E. Ryckman, C. C. Lindt). Specimens collected, one nest contained twenty-two 4th instars, four 5th instars and two adults, ♂, ♀.

Snow Creek, north base of Mt. San Jacinto, Riverside County, California, January 15, 1951, (B. Gerard).

Usinger (1944) has previously reported *P. hirsuta* from Mojave, Death Valley, Palms to Pines Highway, Palm Springs and Boron, California and the Phantom Ranch in the Grand Canyon, Arizona. Wood (1949) reported collections from Gila Bend, Maricopa County, and Brenda, Yuma County, Arizona.

LITERATURE CITED

USINGER, R. L.

1944. The Triatominae of North and Central America and the West Indies and their public health significance. U. S. Public Health Service, Public Health Bull. No. 288, p. 48.

[1] This investigation was supported by a research grant (E-173) from the National Institutes of Health, U. S. Public Health Service.

WOOD, S. F.
1949. Additional observations on *Trypanosoma cruzi* Chagas, from Arizona in insects, rodents, and experimentally infected animals. Amer. Jour. Tropical Medicine, 29(1):43–55.

RECENTLY PUBLISHED

THE COLEOPTERA OF THE GALAPAGOS ISLANDS. By Edwin C. Van Dyke. Occasional Papers of the California Academy of Sciences, No. XXII, pp. [4+] 1–181, incl. 7 pls. July 15, 1953. Price $3.50.

Dr. Van Dyke wrote some of the manuscript for this paper more than 40 years ago, and completed it in 1951. He corrected the first galley proofs prior to his death. The work is based on the large collections made by Dr. F. X. Williams and other members of the California Academy of Sciences expedition to the Islands, 1905–1906, but species previously reported from the Islands are mentioned or discussed. There are descriptions of 71 new species and 10 new subspecies; keys to the species are given for the larger genera; 57 species and subspecies are figured on the plates.

SOME NEW AND NOTEWORTHY APHIDAE FROM WESTERN AND SOUTHERN SOUTH AMERICA (Hemiptera-Homoptera). By E. O. Essig. Proceedings of the California Academy of Sciences, 4th Series, Vol. XXVIII, No. 3, pp. 59–164, 56 text figs. July 15, 1953. Price $2.00.

This is a well-illustrated report on aphids collected in Chile, Peru, Argentina, Bolivia and Colombia by Dr. and Mrs. E. S. Ross and Dr. and Mrs. A. E. Michelbacher, on an expedition for the California Academy of Sciences, December, 1950, to April, 1951; and on a collection from Mendoza Provincia, Argentina, supplied by L. A. Bahamondes. Twenty-five genera, including 55 species (14 new) are treated, and previous South American records are given from the literature. There is a valuable host-plant index (pp. 141–154) wherein the species and their general distribution are cited.

THE CALIFORNIA ACADEMY — LINGNAN DAWN—REDWOOD EXPEDITION. By J. Linsley Gressitt. Proceedings of the California Academy of Sciences, 4th Series, Vol. XXVIII, No. 2, pp. 25–58, 13 text figs. July 15, 1953. Price 60 cents.

A general account, illustrated with photographs, of the expedition to the area around Suisapa (Dawn Valley; much publicized as the Valley of the Tiger), in southwestern Hupeh Province, China. Tens of thousands of insects and other animals were collected, in the hope of finding some ancient faunal elements of possible North American affinity which might have survived with *Metasequoia* and the other ancient trees associated with it. The latest known fossil deposits of *Metasequoia* were laid down in Oregon about 20,000,000 years ago (John Day Miocene). The collections are now at the California Academy of Sciences.—H.B.L.

AN OUTBREAK OF NYMPHALIS CALIFORNICA NEAR LAKE ALMANOR, CALIFORNIA

Lloyd Tevis, Jr.[1]

Department of Zoology, University of California, Davis, Calif.

On July 10, 1951, an outbreak of caterpillars of the California tortoise-shell butterfly *(Nymphalis californica* (Boisduval)) was noted near Lake Almanor in the vicinity of Prattville, Plumas County, California.

The chief shrubs of the coniferous forest at 4500 feet elevation are manzanita *(Arctostaphylos patula* Greene) bitter cherry *(Prunus emarginata* (Douglas) Walpers), squaw carpet *(Ceanothus prostratus* Bentham), and mountain whitethorn *(C. cordulatus* Kellogg), but the caterpillars ate only leaves of the last-named species. Their feeding and defecating produced a continuous crackling sound in the brushfields.

The outbreak covered hundreds of acres but was localized in discontinuous patches which varied in size from few to many shrubs. By the time the caterpillars pupated, which was between July 10 and 14, nearly all the whitethorn of the infested areas had been defoliated. A month later these same shrubs were again fully clothed with leaves.

Caterpillars about to pupate deserted the defoliated whitethorn, migrated across ground, and ascended plants which gave shade and cover. The greatest concentration of chrysalids occurred on the underside of boughs of white fir, but manzanita, willow, cherry, ponderosa pine, Douglas fir, and incense cedar also were utilized. Some caterpillars pupated at ground level; others climbed to a height of ten or more feet.

Caterpillars migrating across ground were attacked by giant carpenter ants *(Camponotus levigatus* (F. Smith)) and golden-mantled ground squirrels *(Citellus lateralis* (Say)). With little effort the squirrels captured any desired number of larvae, and study of the stomach contents of trapped specimens revealed that caterpillars were then the main food.

Not being arboreal, the squirrels took few chrysalids. On the

[1] My records are from an investigation into the influence of rodents on reforestation conducted by the Department of Zoology of the University of California at Davis, in cooperation with the California Forest and Range Experiment Station of the United States Forest Service.

other hand, chipmunks *(Eutamias amoenus* (Allen), *speciosus* (Allen), *townsendii* (Bachman), and *quadrimaculatus* (Gray) seemingly did not relish the hairy caterpillars, and they searched instead in the trees and bushes for chrysalids. *E. amoenus* ate practically nothing else. Doubtless other kinds of rodents, such as the nocturnal white-footed mice, also ate *N. californica* stages, but no study was made of their feeding habits.

Sometimes a chipmunk would be attracted by a pendulant chrysalid thrashing widly from side to side and audibly striking an adjacent leaf or twig. In one instance, I noted a small wasp clinging to a swinging chrysalid. In spite of the violence of the movements, it was not dislodged. Parasitism by wasps could not have been heavy, for at least 80 per cent of some 50 pupae that I collected survived to maturity, and many of those that died had been damaged in transit.

When I returned to Lake Almanor on August 14, the butterflies had emerged and gone. None was to be seen. Presumably they had migrated to the northeast into Lassen National Park and surrounding areas.

According to the Park Naturalist, Mr. P. E. Schulz, the invasion of the park was one of the heaviest on record. He noted the first swarm on July 26, but the greatest number of butterflies did not appear until early August. One ranger saw a tremendous concentration of them flying up the nearly vertical face of Brokeoff Mountain, streaming over the ridge some two to four feet above the top, and cascading down the opposite side. The insects seemed to drift with the air currents. On August 19, I saw innumerable butterflies ascending the barren east slope of Mount Lassen and swirling about the summit at an elevation of over ten thousand feet. A severe hailstorm that afternoon killed or drove them away. Storer (1933 Pan-Pacific Entomologist, 9(2):67–68) recorded myriads of butterflies of this species streaming up the east slope of Mount Lassen on July 30, 1931.

At Lake Almanor in 1951 there was no further occurrence of caterpillars, at least until mid-September when I left the region. In regard to predation it should be noted that rodents which ate caterpillars and chrysalids were numerous; yet they did not prevent a major outbreak of the butterflies. I observed no predation by birds. In 1911, Bryant (Condor, 13(6):195–208) found that the Brewer blackbird destroyed a significant number of butterflies.

ON SOME NEOTROPICAL PASSALIDAE

(Coleoptera)

P. H. Van Doesburg
Baarn, Nederland

During the past three years I have had the pleasure of studying and identifying the extensive collection of Passalidae in the California Academy of Sciences, San Francisco. I wish to express my sincere thanks to the Department of Entomology there and to Hugh B. Leech, in charge of Coleoptera, for enabling me to examine the collection.

As usual most of the beetles belong to those species which are abundant in every collection, for example *Popilius disjunctus* Illiger, *Passalus punctiger* St. Fargeau et Serville, *Passalus interstitialis* Eschscholtz, etc. Nevertheless a few species, among which one is undescribed, are worth mentioning. A note on a specimen in my private collection may be added.

Popilius lenzi Kuwert

Kuwert, 1897. Novitates Zoologicae, 4:301.

The locality of this species, mentioned by Kuwert—the Cocos Islands—has been questioned, the genus being strictly neotropical and all students in Passalidae thinking of the Cocos Islands situated south of Java. There were many specimens of *P. lenzi* in the Academy's collection and Mr. Leech wrote me: "There are two Cocos Islands. The one you have in mind is doubtless that also called Keeling Isl., SW. of Java. But the other one, and the one on which our specimens of *lenzi* were taken, is SW. of Panama, approximately half way between Panama and the Galapagos Islands. It belongs to Costa Rica." Mr. Leech generously sent a beautiful series of *lenzi* for my private collection.

Popilius tenuis Kuwert

Kuwert, 1897. Novitates Zoologicae, 4: 290.

Kuwert placed this species under his genus *Petrejoides*. Gravely (Memoirs Indian Museum, 7(1): 22, 1918) records *Petrejoides* as a synonym of *Pseudacanthus* Kaup. In the Academy's collection I found one specimen agreeing exactly with Kuwert's description of *tenuis*. The elytra are *not* fused, as is the case in *Pseudacanthus*, consequently the species must be placed under *Popilius* Kaup.

Paxillus schneideri Kuwert

Kuwert, 1898. Novitates Zoologicae, 5:301.

Mitrorhinus Kaup, by all recent students in Passalidae taken

as a subgenus of *Passalus* Fabricius, contains those species which have a median angular process on the anterior margin of the head. A specimen in my private collection agrees fairly with Kuwert's description of *M. schneideri*, and is also from Peru. The antennae, however, have 5 lamellae; in consequence this specimen should belong to the genus *Paxillus!* Kuwert does not say anything about the antennae.

Passalus dominicanus van Doesburg, new species

This species belongs to the subgenus *Pertinax* Kaup, (amend. Luederwaldt). It is distinguished by the anterior border of the head, the clypeus being visible, separated from the anterior margin by a dull groove running between the outer tubercles. Moreover there is a shallow concavity between the outer tubercle and the angle of the head. This concavity is also dull in contrast with rest of the surface of the head, which is smooth and shining.

Labrum coarsely punctured, hairs long, sides somewhat convergent. *Mandibles* each with three terminal teeth. *Anterior border of head* between outer tubercles straight, without secondary tubercles; below anterior border the *clypeus* is visible as a narrow, vertical burr, separated from anterior border by a dull groove. *Central tubercle* not prominent, careniform, united at its base with the low parietal ridges. *Inner tubercules* less widely separated than outer tubercles, situated nearly half way between central and outer tubercles; they are long, stout, directed forwards and united with central tubercle by straight frontal ridges. The frontal angle is about 90°. Between outer tubercle and anterior angle of head a transverse, dull concavity. *Canthus* prominent laterally beyond eyes. *Occiput* right behind eyes coarsely punctured and provided with a tuft of thick, stiff bristly hairs. Anterior margin of *mentum* concave on either side of middle, primary scars present; middle of mentum smooth, lateral lobes coarsely punctured and hairy. *Antennae* with 3 long lamellae, wholly covered by long, brown hairs.

Pronotum transverse, smooth, with sparse, microscopical punctures all over, median groove complete and very distinct; marginal grooves broad, irregularly provided with coarse punctures, just as their enlarged anterior ends; a few punctures in the distinct scars. *Scutellum* smooth.

Elytra together nearly twice as long as broad, their sides parallel; distinctly grooved, dorsal grooves distinctly punctured, lateral grooves with coarse punctures. *Elytra* and *epipleurae* without hairs. *Metasternal plate* and *intermediate areas* united, entirely smooth, a few punctures only in hind corners. *Lateral areas* narrow, linear, glossy, without hairs. *Scars* of mesosternum scarcely indicated. Anterior angle of mesosternum with two groups of hair-bearing punctures, rest of mesosternum smooth and hairless. *Abdominal sterna* polished, also in the scars. *Legs* but thinly hairy, middle and hind legs without spines. Length 27 to 28 mm.

Six specimens from LA CAPITO, ST. DOMINGO, March 5, 1917,

(R. H. Beck coll.). *Holotype* and 3 *paratypes* in the collection of the California Academy of Sciences, San Francisco, 2 *paratypes* in my collection.

I am indebted to Mr. W. D. Hincks of Manchester, England, for confirming my opinion that the species is new.

NEW RECORDS OF ARACHNIDA FROM ALASKA

(Araneida, Phalangida)

BORYS MALKIN

University of Washington, Seattle, Wash.

During the summer of 1951 I spent ten weeks in southeastern Alaska, from the second half of July until the end of October. Although insect collecting was unfortunately incidental to my main occupation a considerable collection was accumulated and in it nearly 1000 specimens of spiders representing 59 species. Several of these are new, and 16 others are not listed from Alaska by Chamberlin and Ivie[1]. Since the new species must await description, only new records will be mentioned here. In addition to the spiders four species of Phalangids were taken of which two, according to Dr. Clarence J. Goodnight of Purdue University who identified them, are additions to the Alaskan fauna in that group. It might be commented by the way that the spider fauna of Alaska must be very imperfectly known if 59 species were taken in a relatively short period of time in an area (southeastern Alaska) from which Chamberlin and Ivie list only 86 species! The entire spider collection is placed in the American Museum of Natural History and for the identification of it I am indebted, as usual, to my friend Dr. Willis J. Gertsch of that institution.

ARANEIDA

Antrodiaetus pacificus Simon. Ketchikan, July 28, (1 male).

Pardosa metlakatla Emerton. Wrangell, July 30–Aug.. 4, (3 females).

Clubiona norvegica Thorell. Port Beauclerc in Kuiu Isl., Aug. 6, (1 female).

Clubiona trivialis Koch. Ketchikan, July 18–28, (1 male and 3 females).

Xysticus pretiosus Gertsch. Ketchikan, July 18–28, (1 male and 1 female); Wrangell, Sept. 1–20, (1 female).

Misumena vatia Clerck. Ketchikan, July 18–28, (20 specimens, of both sexes, adult and immatures); Wrangell, Aug. 1–4, (1 female).

Sitticus palustris Emerton. Totem Bay in Kupreanof Isl., Aug 17–18, (30 specimens of both sexes adult and immature). These spiders were collected from under stones and rocks exposed by the tide. Undoubtedly the animals hide in a dense web with which they enmesh themselves when the tide floods their refuge. Mr. Paul Macy of the U. S. Fish and Wildlife Service and I observed also pseudoscorpions surviving the incoming tides in the same manner in Totem Bay, and elsewhere in similar situations.

Metellina curtisi McCook. Wrangell, Sept. 1–20, (1 female); Ketchikan, July 18–28, (4 females); Port Protection on Prince of Wales Isl., Aug. 10–20, (2 males); Point Barrie on Kupreanof Isl., Sept. 9, (2 females); Manefee Inlet in Etolin Isl., Sept. 22, (1 female); Mayer's Chuck on Cleveland Peninsula (mainland), Sept. 22, (1 female).

Aranea gemmoides Chamberlin & Ivie. Ketchikan, July 18–28, (1 male).

Pityohyphantes robrofasciatus Keyserling. Wrangell, Aug. 1–4, (1 immature).

Linyphia digna Keyserling. Wrangell, Aug. 1–4, (1 male).

Leptyphantes ziba Korsch. Wrangell, Aug. 7–12, (1male).

Collinsia ksenia Crosby & Bishop. Wrangell, Aug. 1–4, (4 females); Port Beauclerc in Kuiu Isl., Aug. 6, (1 female).

Erigone metlakatla Crosby & Bishop. Big Castle Isl. in Duncan Canal, Aug. 27, (3 males, 1 female); Castle River on Kupreanof Isl., Aug. 28, (2 males, 3 females).

Erigone whymperi Cambridge. Big Castle Isl. in Duncan Canal, Aug. 27, (20; both sexes); 10 miles east of Wrangell on mainland, Sept. 20, (12; both sexes); Wrangell, Sept. 1–20, (6 males, 1 female); Ideal Cove in Mitkof Isl., Sept. 4, (1 male); Falls Creek on Mitkof Isl. (Wrangell Narrows), Sept. 1; Three Mile Arm in Kuiu Isl., Sept. 10, (2 males); Menefee Inlet in Etolin Isl., Sept. 21, (1 male, 3 females); Red Bay in Prince of Wales Isl., Sept. 14, (20; both sexes); Scenery Cove in Thomas Bay (mainland), Sept. 2, (6 males, 2 females).

PHALANGIDA

Leuronychus pacificus Banks. Ketchikan, July 18–28; Wrangell, July 30; and the following localities on Prince of Wales Island: Red Bay, Aug. 9; Port Protection, Aug. 10–20; 6 miles east of Point Baker, Sept. 15.

Phalangium opilio L. Ketchikan, July 18–28; Wrangell, Aug. 1–4. This very common species usually lives in close association with men and follows them. According to Dr. Goodnight it is found in the northern U.S.A., Canada, northern Europe, and Siberia, so its presence in Alaska is to be expected. It seems strange though that such a large and common form is not officially reported from that area.

REFERENCE

CHAMBERLIN, R. V. and IVIE, W.

1947. "The Spiders of Alaska." Bull. of the Univ. of Utah, 37 (10): 1–103, 99 figs. (A total of 247 species of spiders is listed for Alaska, 86 of which are found in southeastern Alaska.)

NOTES ON NOMENCLATURE AND RELATIONSHIPS OF SOME PALEARCTIC AND NEARCTIC LEPTURINAE

(Coleoptera : Cerambycidae)

J. L. Gressitt

Bernice P. Bishop Museum, Honolulu

In the "Longicorn beetles of China"[1] I united certain genera of Lepturinae as subgenera, but now feel that they are distinct. I am indebted to Mr. R. A. Crowson and Mr. E. A. J. Duffy for pointing out significant differences. *Centrodera* and *Apatophysis* are generically distinct (see Longicornia, 2:48). *Toxotus* and *Oxymirus* are generically distinct (see Longicornia, 2:56). *Rhagium* is to be reinstated as a genus, as *Stenocorus* Geoffroy has no standing, having been used in a polynominal system. The "subgenus *Stenocorus* (s. str.)" reverts to subgenus *Allorhagium*. (See Longicornia, 2:54).

Pseudopachyta Swaine and Hopping is a synonym of *Sachalinobia* Jacobsen. While helping me sort longicorns at the California Academy of Sciences, Mr. Hugh B. Leech detected the close relationship of the Nearctic to the Palearctic forms. *Sachalinobia koltzei* is probobaly a subspecies, at best, of *Pseudopachyta rugipennis* (Newman). The California Academy of Sciences collection contains only females of *rugipennis* and only a male of *koltzei*. The two forms may be cited provisionally as follows:

Sachalinobia rugipennis rugipennis (Newman) new combination

Toxotus rugipennis Newman, 1844, Zoologist, 2:476.

Evodinus rugipennis Aurivillius, 1912, Coleopt. Cat., 39:188.

Pseudopachyta rugipennis, Swain & Hopping, 1928, National Mus. Canada, Bull. No. 52: 14 (key), 16 (descr.).

Host: Pinus.

Distribution: Eastern Canada and northeastern U.S.: Ontario, Quebec, New Brunswick, Nova Scotia, Maine, Michigan.

Sachalinobia rugipennis koltzei (Heyden)

Brachyta koltzei Heyden, 1887, Deutsche Ent. Zeitschr., 31:304.

Sachalinobia retata Jacobson, 1899, Ann. Mus. Zool. St. Petersburg, 4:40.

Sachalinobia koltzei, Jac., 1902, Deutsche Ent. Zeitschr., (1902):363; Gressitt, 1951, Longicornia, 2:55.

Host: Abies.

Distribution: E. Siberia; Manchuria; Korea; Sachalin; Japan (Hokkaido, Honshu).

[1] Longicornia (Paris), 2: 1-667, 22 plates, 1 map, 1951.

DEFORMED ABDOMINAL TERGITES IN MUSCA DOMESTICA LINNAEUS

(Diptera: Muscidae)

CHARLES P. HOYT

Natural History Museum, Stanford University, California

While examining the specimens of *Musca domestica* discarded from a genetical experiment being carried on by Mr. Wm. Cloughley of Stanford University, the author came upon a number of individual flies which exhibited abnormal developments of the abdominal tergites. Mr. Cloughley kindly consented to make further rearings of the strain in which a great number of individuals showed deformities of the third abdominal tergite. However, due to some unpredictable misfortunes this strain was lost before any conclusive data could be gathered. It is felt by the author that the nature of the abnormalities and the results which were obtained from the few successful crosses might be of interest, especially since similar developments have been noted in *Drosophila melanogaster* Meigen (Bridges and Morgan, 1911) and in *Calliphora erythrocephala* (Meigen) (Fraenkel and Harrison, 1938).

The abdominal deformities illustrated here are of specimens obtained during these rearing experiments. All drawings were made from the dorsal aspect. The retractable abdominal segments of the females are not shown in these illustrations and the terminal, under-curved, abdominal segments of the male are likewise omitted.

Figure 1A illustrates a female in which the third abdominal tergite is developed only on the right side. Figure 1B depicts a female in which both right and left sides of the third tergite are developed, but the central section is absent. Figure 1C is of a normal female. Figure 1D illustrates a female in which the fourth abdominal tergite formed only on the left. In this specimen there are additional deformities of the sixth and seventh abdominal segments. Figure 1E shows the abdomen of a male in which the third abdominal tergite is developed only on the right.

The examples shown in figures 1A, B, C and E were taken from a particular inbred strain. These illustrate all of the types of deformities noted in the progeny of this strain. The example depicted by Figure 1D illustrates a type of deformity found in two individuals of an entirely separate strain of flies originating from a different geographical locality.

The first cross, made after the discovery of the abnormalities of the third tergite type, was between two normal flies from this strain. This resulted in a total of 23 adult progeny, of which 17 per cent were deformed. The second cross, again made with normal flies from this stock, resulted in 5 per cent abnormal individuals. From these progeny five crosses were attempted between abnormal, normal with abnormal, and normal with normal flies. Only one of these, that of normal with normal, produced eggs. Several genera-

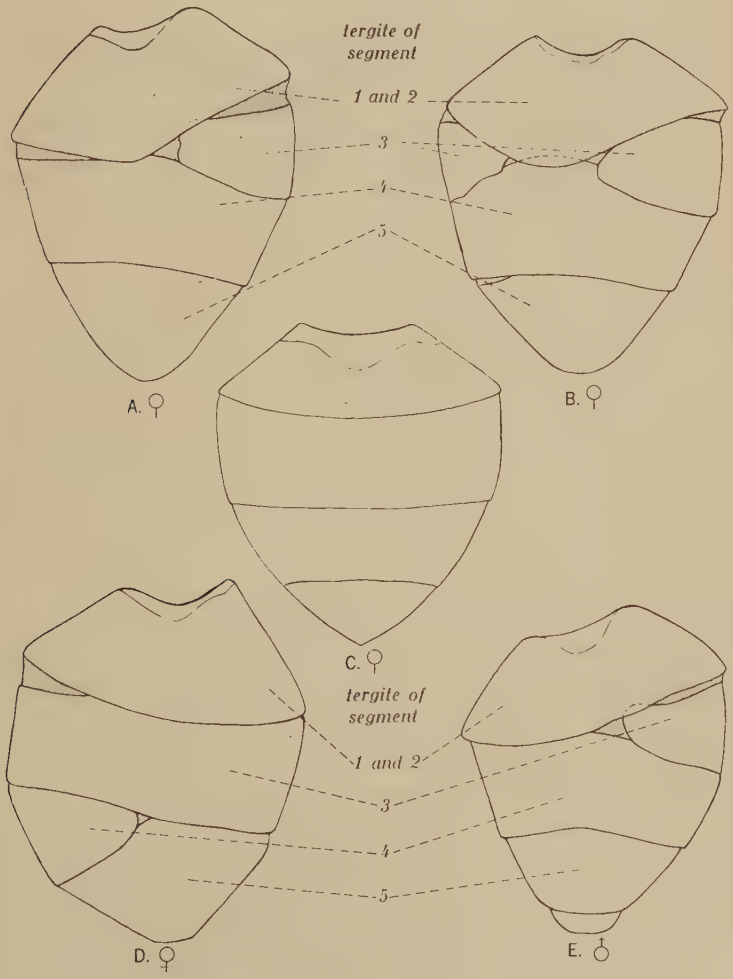

Fig. 1. *Musca domestica* Linnaeus, Abdomina, dorsal aspect.

tions later (because of the absence of the author the intervening progeny were not examined) counts were again made of progeny from a mass culture of this strain. This fairly large group of flies contained approximately 20 per cent deformed individuals. All of these were deformities of the third abdominal tergite of the types illustrated by figures 1A, B and E. In all of the progeny observed the deformities were slightly more common in the females than in the males, although there did not seem to be any significant difference in numbers.

It seems unlikely that this deformity was caused by an environmental factor such as deficient nutrition, as the flies of this strain and of other strains were reared under nearly identical conditions. Only this particular strain showed abnormalities of the third tergite and these appeared in more than six generations. However, due to the aforementioned circumstances no data were gathered definitely indicating the inheritable nature of this interesting development.

Literature Cited

Bridges, C. B., and Morgan, T. H.
1919. The second chromosome group of mutant characters. Carnegie Institute of Washington Publication No. 278, pages 123–304 and plate 11.

Fraenkel, G., and Harrison, J. L.
1938. Irregular abdomina in *Calliphora erythrocephala* (Mg.). Proceedings of the Royal Entomological Society of London, Series A, General Entomology, 13: 95–96, fig. 3.

ORTHEZIA ANNAE COCKERELL FOUND IN IDAHO.—The scale insect *Orthezia annae* Cockerell is known only from several widely scattered localities in the southwestern United States. It has been recorded from Presidio, Texas; Las Cruces, New Mexico; "Arizona"; Palm Springs, California; and Fallon, Nevada. During 1952 several collections, constituting a considerable northward extension of the known range of this species, were made in southeastern Idaho. Both adult females and nymphs of *O. annae* (determined by Harold Morrison) were collected in the vicinity of Malta, Cassia County, during March, July and September by G. Zappettini, L. A. Sharp and the writer. This scale was found on the roots of shadscale, *Atriplex confertifolia* (Torr.) and saltsage, *A. nuttalli* S. Wats. and was associated with an ant, *Campanotus vicinus* Mayr (determined by M. R. Smith). The coccinellid, *Brumus parvicollis* Casey was commonly encountered on shadscale plants, where it was observed feeding on *O. annae*.—W. F. Barr, University of Idaho, Moscow, Ida.

THE DIGGING AND PROVISIONING BEHAVIOR OF AMMOPHILA SAEVA SMITH

(Hymenoptera: Sphecidae)

J. W. TILDEN

Department of Biological Science
San Jose State College, San Jose, Calif.

During the summer of 1949 individuals of this species were found on the floor of Bixby Canyon, Monterey County, California, and the activities of the females were observed. According to William Donald Murray (personal communication) *Ammophila saeva* Smith is distinct from *A. procera* Dahlbom. It seems of interest therefore to record the behavior of *A. saeva* and to compare with that of *A. procera*. The habits of the two species are very similar; those of *A. saeva* seem not to have been recorded previously[1].

OBSERVATIONS ON AMMOPHILA SAEVA SMITH

On June 30 a female was seen digging in dry alluvial soil containing numerous small gravelly deposits, The soil was friable but somewhat firm, and in all subsequent cases where digging was noted, it was done in soil of this type. Natural consolidations were seldom chosen, but roadways, paths and abandoned campsites, where the activities of man had packed the earth, were favored by the wasps. Most of these areas were quite close to the stream. The light sediments at some distance from the stream seemed to be entirely unsuited to the activities of the insect.

The burrow was far advanced when first located. When the wasp went below it stayed for two to three seconds, returning with a load of material in its mandibles. It backed out, turned to the right, and deposited the earth about five inches away from the opening, then returned to the left and entered the hole head first. In each case the same movements were made. In a few instances it returned to the right instead of to the left, but in no case did this individual turn to the left in approaching the mound of excavated earth. These movements resulted in the execution of small circles on the ground: out to the right, back to the left.

The wasp ceased digging after twenty minutes and closed the

[1] ACKNOWLEDGMENTS—Special thanks are due to Dr. William Donald Murray for identification of the wasp, and for reference, without which no comparison of the habits of various species would have been possible. His help and encouragement are gratefully remembered. The determination of **Hilarella** and a reference to its biology are due to the kindness of Dr. Curtis W. Sabrosky.

opening with a small rock about one-half inch in diameter. The rock was straddled and seemed to be grasped mostly in the mandibles. It is not clear that the fore legs assisted in the process. After closing the opening, the wasp flew away. It had not returned in half an hour, so the burrow was investigated. The pile of removed earth measured three and one-half by two inches, but the boundaries were irregular. The rock closure was lifted and the hole below was found to be open.

Later the same day, the burrow was found sealed and with a small piece of wood covering the place where the opening had been. The area had been smoothed and the piece of wood looked like any number of others in the vicinity. If the site had not been marked by a small stake, it might not have been rediscovered by the observer. A second burrow had been dug about twenty inches from the first, and also covered, this time by two pebbles inserted deeply into the opening.

When by noon the next day (July 1) the wasp had not returned, the first burrow was dug out and found to be three and one-fourth inches deep and to extend more than six inches back from the opening. The diameter of the vertical part was between one-half and three-fourths inches, but irregular and varying because the wasp had gone around the larger pebbles. The chamber at the end of the horizontal portion was about two inches long and one inch in height. This chamber was the only part of the tunnel that had not been refilled, but dimensions in the rest were not difficult to take since the loose material lay at different angles than the original soil. The chamber was provisioned with a single larva of the sphingid moth, *Smerinthus cerisyi* Kirby, which was one and three-fourths inches in length. A single egg had been laid on the pleuron of the last segment just above the right side of the anal prolegs. The second burrow was also dug out and found to be similar in most respects, with allowances for the differences in the soil.

On July 3 a female, presumably the same one, was collected and on July 13 a male. No other specimens were taken although several were observed from time to time.

At noon on July 12, another female was seen working in the same area. By 3:15 p.m. she had nearly completed her burrow, to judge by the size of the excavation pile. She dug as had the other, by means of mandibles only, and carried the earth farther from

the opening, depositing it about seven inches from the hole. This seemed to be an individual character in these wasps, each having a characteristic carrying distance because of the size of the circle started upon leaving the opening with a load. Whereas the previous female had turned always to the right when carrying the earth, this one turned to the left and returned to the right. It was a "left-handed" individual.

As the wasp dug, small flies loitered around the opening. They were very agile and active. One only was taken; it was identified by Dr. Curtis Sabrosky of the United States National Museum as *Hilarella hilarella* (Zetterstedt) (Sarcophagidae). Dr. Sabrosky informs me that there are a number of related species with these habits and suggests that if more had been collected, other species might have been represented. Allen (1926) reviewed the species of these flies, and mentioned that J. B. Parker found they larviposit, the small larvae perhaps, being dropped into the mouth of the wasp's burrow. In one case eight maggots were reared from a caterpillar found in the burrow of *Sphex extrematata* var. *pictipennis* Walsh. He stated that M. R. Smith seemed to find that eggs were laid on the caterpillar before it was put in the burrow. (Since these flies, in common with many Sarcophagidae, have been observed to larviposit, it may be that small larvae rather than eggs were laid on the larvae.)

The wasp left the area at 3:51 p.m. without covering the opening. This individual never covered the burrow upon leaving it. At 4:14 p.m. it returned, made a sweeping flight around the area, investigated the vicinity of the burrow and began at once to dig. In every observed instance, returning females behaved in a similar fashion when returning without provisions. Returning empty-handed was by flight, and the burrow investigated prior to resumption of digging.

At 4:22 p.m. the wasp stayed below and did not come out again that evening. By this time the spot had become shaded and cool, and it was found on this and other occasions, that relatively high ground temperatures were necessary to the insect's activity. The wasp spent the night in the burrow, as was tested by placing a rather large rock over the opening. Next morning when the weather cleared, the rock was removed and the wasp came out and flew directly away.

The next day (July 13) was clear in the morning but fog rolled

in early in the day and no digging was noted. The wasp was seen to investigate the hole but instead of digging she ran along the ground to the edge of the nearby vegetation and rested in the dry grass, where she spent the night. It seemed a matter of circumstances whether the night was spent in the burrow or not. Both types of behavior were noted several times.

Duties prevented observations for three days, but on July 17 a female, presumably the same one, was observed covering a hole. The wasp scratched with the prothoracic legs in a circular motion, moving around the hole and throwing the dirt back between the other two pair of legs. Most of the covering was done by backing up to the opening. When the hole had been filled to somewhat above the surrounding level, a small rock was placed on the mound. In this instance no stone was used for tamping.

Without resting, the wasp began to investigate the surrounding area. After about ten minutes, she selected a spot some three inches from the previous site and began to dig. She apparently did not encounter any underground obstacles, since excavation was unusually rapid and seemingly complete in 72 minutes. She then flew away without covering the opening. She also turned to the left in digging, and this together with the habit of not covering the opening led to the assumption that it was the same individual as before. The day turned cold and the wasp did not return that evening.

It was 3:20 p.m. the following day (July 18) before further observations could be made. The wasp was not in evidence, and the hole was still open. The nearby covered hole was dug out; it contained a *Smerinthus* larva. No egg was found, and at the time it was supposed that it had been brushed off during the excavation, but observations by Criddle (1924) may place a different interpretation on the matter. He describes how a caterpillar of the related *Smerinthus geminatus* Say *(S. jamaicensis* Drury of the present lists) was buried by *Ammophila procera* on one day and exhumed the following day to be oviposited on.

After the caterpillar had been examined, both the dug out and the open hole were filled and the area smoothed, and the return of the wasp was awaited. She returned soon, at 3:31 p.m., dragging a large *Smerinthus* larva. The wasp was astride the larva, holding it near the head in the mandibles, and walking on all six widely-

spaced legs. The larva seemed not to be any great burden to the wasp, which moved rapidly and easily.

The wasp was disturbed to find no hole, and walked around the exact location of the now filled-in opening, still dragging the larva. Then she set the caterpillar down a short distance away and investigated the area most carefully, returning occasionally to reexamine the larva. After some ten minutes of these actions, the wasp selected a new site and began to excavate a new burrow. She dug very rapidly, making numerous loud buzzing sounds. Soon the burrow was deep enough so that the wasp was underground for several seconds, and during one of these trips the larva was removed and examined. No egg was found, so it seems that oviposition may occur after the larva is placed in the burrow. The larva was returned as nearly as possible to the same place.

At 4:12 the burrow was complete and the wasp took wing and flew several times in long low sweeps around the vicinity. She located the larva from the air, dropped to the ground beside it, resumed a position astride the larva and dragged it to the new burrow. She dropped the larva an inch or so from the mouth of the burrow and went down into the hole, returning with a load of earth. Two such trips were made. Then she backed into the opening, dragging the larva after her, not straddled, but seized in the mandibles. No egg was deposited at this time. The wasp remained below nearly three minutes, and when she returned to the surface was carrying more material. Several more trips were made, each with a load of earth. On one of these trips a large rock was placed over the opening by the observer, to prevent the wasp from coming out. She could be heard buzzing loudly below, but when the rock was removed continued her work without concern. This last excavation required eight minutes, and may have been a final cleaning out of the chamber.

Next the wasp retired a foot or so from the nest, and groomed her antennae for a short time. Then she began to gather pebbles about one-fourth inch in diameter and to dump them into the burrow. The observations at this time were made from about 18 inches without disturbing the wasp. The observer placed pebbles of an appropriate size near the opening and these were accepted and used. Small pebbles and larger rocks placed in the same way were examined, apparently being measured by the expanse of the mandibles, and discarded without being used.

When the hole was nearly full of pebbles, perhaps three-fourths of an inch from the top, the wasp began to fill the remainder with gravel and sand. As before, she faced away from the burrow and loosened the earth with her mandibles, then kicked it backwards with the prothoracic legs, the material passing between the other two pairs of legs and beneath the upraised abdomen. During this process, she stopped from time to time and seizing a small rock in her mandibles, carried it to the hole and used it to tamp the earth in the opening. The tamping was quite vigorous, the wasp raising the fore part of the body and beating the loose earth with a pushing motion. At the termination of each tamping act, the rock that had been used was either placed in the opening or laid beside it, while another layer was kicked in. Each time a different rock was used for the tamping. When the hole was slightly more than flush with the surface, a small rock was placed over the spot where the hole had been. Then the surrounding area was carefully smoothed. The filling of the hole with small material, including the use of the rocks as tools, took one minute and thirteen seconds.

The wasp then sought a sheltered and sunny location and groomed herself, after which she rested for nearly four minutes. She then began to search the vicinity, taking short filight and alighting repeatedly. However, no more excavation was done that day. The time was nearly five o'clock and day had become cool. The wasp flew away and did not return. The small *Hilarella* flies remained near the burrow during the entire process, even entering the hole while the wasp was below, but the wasp did not appear to notice them in any way. The caterpillar was then dug out but again, no egg was found.

Other excavations were observed on several occasions, without significant deviation from the patterns recorded above.

Comparison of the Behavior of Ammophila Saeva With That of A. Procera and Certain Other Related Forms

The habits of certain species, mostly in eastern United States, have been recorded numerous times. Wheeler and Wheeler (1924) note the use of pebbles by these wasps in tamping the burrow, and state that seven observers have recorded this act since it was first described by Peckham and Peckham (1898). The Peckhams remarked that *A. urnaria* used the same pebble each time, so in this respect *A. saeva* differs, but such a difference may well be individual rather than specific.

Although the Wheelers credit the Peckhams with the first observation of the use of pebbles as tools by these wasps, two earlier records exist. Pergande (1892) observed the use of pebbles in this way by *A. gryphus* and stated that the tamping made audible sounds. Williston (1892) also recorded the use of pebbles by *A. yarrowi*. These seem to be the first published notes on this tool-using behavior by members of the genus *Ammophila*. The many later records indicate that it is most likely a usual habit.

All references consulted gave the provision of the burrow as lepidopterous larvae. Most of the references refer to the captured larvae as prey. But since the larvae are not eaten by the adult but used to supply food for the young, the term provision is preferable. In addition to the use of *Smerinthus* larvae (Criddle, 1924), Rau (1926) found that *A. procera* provisioned with a noctuid (phalaenid) larva. Hartman (1905) found that *A. procera* used a "tomato worm" (Sphingidae), and laid the egg on the 6th to 10th segment of the abdomen, while Pergande (1892) noted the utilization of the larva of *Heterocampa sub-albicans* Packard (Notodontidae).

Rau (1922) wrote that *A. procera* carried earth from the burrow in short flights, which is unlike the habits of *A. saeva*. Whether this is a real difference of behavior or merely a difference in description by two different authors, is not clear.

The specific names of the insects are given just as found in the literature without any attempt to bring them in line with modern classification, since the systematics of these insects is in no way part of this paper.

Summary

Observations on *Ammophila saeva* Smith indicate that the wasp provisions the nest with the larva of *Smerinthus cerisyi* Kirby and uses pebbles to tamp the earth in the burrow. The habits of *A. saeva* are similar to or nearly identical with those of related species; the differences are slight enough to be individual and not specific. It would seem that the digging and provisioning habits of the genus *Ammophila* may be considered to form a generic rather than a specific habit pattern. Wheeler and Wheeler's statement that the Peckhams were the first to observe the use by these wasps of pebbles as tools is incorrect, since both Pergande and Williston made such observations earlier.

LITERATURE CITED

ALLEN, HARRY W.
1926. North American species of two-winged flies belonging to the tribe Miltogrammini. Proceedings of the United States National Museum, Vol. 68, Article 9, page 81.

CRIDDLE, NORMAN
1924. Observations on the habits of *Sphex procera* in Manitoba. The Canadian Field Naturalist, 38 (7): 121–123.

HARTMAN, CARL
1905. Observations on the habits of some solitary wasps of Texas. Bulletin of the University of Texas, 65, Science Series 7, pp. 1–73 (11–20 apply).

PECKHAM, G. W., and ELIZBETH PECKHAM
1898. On the instincts and habits of the solitary wasps. Wisconsin Geological and Natural History Survey, Bulletin 2, Scientific Series 1, page 23.

PERGANDE, THEODORE
1892. Peculiar habit of *Ammophila gryphus* Sm. Proceedings of the Entomological Society of Washington, 2 (2): 256–258, 1 text fig.

RAU, PHIL
1922. Ecological and behavior notes on Missouri insects. Transactions of the Academy of Sciences of Saint Louis, 24 (7): 1–75.
1926. The Ecology of a sheltered clay bank; a study in insect sociology. Transactions of the Academy of Sciences of Saint Louis, 25: 157–277.

WHEELER, GEORGE C., and ESTHER HALL WHEELER
1924. The use of a tool by a sphecid wasp. Science, LIX, No. 1535, p. 486.

WILLISTON, S. W.
1892. Note on the habits of Ammophila. Entomological News, 3 (4): 85–86.

NEW RECORDS OF OXYPORUS FROM ARIZONA (Coleoptera: Staphylinadae).—A specimen each of *Oxyporus quinquemaculatus* Leconte and of *O. mexicanus* Fauvel were taken by the writer in the pine-Douglas fir forest at Rustler Park, Chiricahua Mountains, Arizona, on Sept. 15, 1952, at about 8,300 feet altitude. Five additional specimens of *O. mexicanus* labeled "Huachuca Mts., Carr Cn., Ariz., VIII–6–1924, J. O. Martin, Collector" are in the collection of the California Academy of Sciences, San Francisco. All these represent new records for the Southwest, *O. quinquemaculatus* having been recorded previously from the eastern United States and *O. mexicanus* from Oaxaca in Mexico. For the latter species, these represent the first United States records. Since the species of *Oxyporus* are mushroom inhabiting forms, it may be assumed that *O. mexicanus* was found in the high mountains of Oaxaca where the fungi are likely to be present.—BORYS MALKIN, University of Washington, Seattle.

A NEW SPECIES OF ACMAEODERA FROM WESTERN NEVADA

(Coleoptera: Buprestidae)

JOHN P. FIGG-HOBLYN

Natural History Museum, Stanford University, California

Acmaeodera nanbrownae Figg-Hoblyn, new species

Small, elongate, subcylindrical, moderately convex, broadly rounded in front, moderately narrowed posteriorly; head, pronotum, and undersurface aeneous; elytra shining black with irregular generally vittate, straw yellow maculations, lineate in the sutural and lateral areas, broken in the discal area, the median portion lineate, its apical area irregularly arcuate, and joined to the apical markings; the vertex and pronotum with short white hairs, suberect and arcuate forwards; the front of the head, sides of the pronotum, and entire undersurface of the body except head, densely clothed with closely appressed, fimbriate, white scales.

Head with median dorsal carina, nearly flat in front, feebly, longitudinally depressed between eyes, finely, shallowly, sparsely punctured with short, arched setae arising from the punctures; antennae extending to basal fourth of pronotum; segment 1 elongate, as long as following three segments combined; segment 2 globose; segments 3 and 4 slightly narrower than 2, and subequal in length to each other; segments 5 to 11 compact, twice as wide as long, the fifth triangular; clypeus broadly, shallowly, arcuately emarginate in front.

Pronotum wider than elytra, twice as wide as long, widest behind middle, and wider at base than apex, apex distinctly bisinuate, sides broadly rounded, unevenly arcuate, side margins not evident from above; disk convex, shallowly caniculate with a slight depression in middle at base; surface finely, shallowly, and sparsely punctured, moderately covered with long, fine curved hairs, intermixed with white fimbriate scales at edges.

Elytra at base narrower than prothorax, sides very slightly expanded behind base, constricted in front of middle and rounded to apex; margins serratulate for apical half, disc convex, striae moderately well-marked, punctures shallow and separated by more than their own width, interspaces flat and sparsely, minutely punctured, each pit giving rise to a short seta.

Undersurface coarsely, densely punctured in front, finely, sparsely punctured behind, and clothed by a dense white mantle of sub-stellate scales; apical carina not present; prosternum retracted, apical margin transverse; legs moderately pilose, undersides of femurs scaled.

Length 8 mm., breadth 3 mm. (in type). In paratypes length ranges to 6 mm., width 1.75 mm.

Holotype, (California Acad. Sci., Ent.) collected by the author in ESMERALDA COUNTY, NEVADA, ten miles northwest of Tonopah, June 24, 1951, on Nevada indigo bush, *Dalea polyadenia* Torr.

Paratypes: Five specimens collected by the author at the mouth of Telephone Canyon, Pilot Mountains, Mineral County, Nevada in July of 1952, four of which are in the Museum of the California Academy of Sciences. All were taken from the flowers of the desert trumpet, *Eriogonum inflatum* Torr. and Frem.

Acmaeodera nanbrownae is placed in the Truncatae section of the genus, and is closely related to and similar in general appearance to the other scaled forms in this group, particularly *A. vanduzeei* Van Dyke, *A. fisheri* Cazier, and *A. fisheri* var *vermiculata* Knull.

In general form *A. nanbrownae* is more elongate and narrow, more attenuated in apical half, and more suddenly constricted in front of the middle than the stubbier, more compact *A. fisheri*. The new species is very similar in appearance to *A. vanduzeei*, but the

Fig. 1. *Acmaeodera nanbrownae* Figg-Hoblyn

elytra are more sinuate in the middle, and the evenly sinuate form of the pronotal sides of the latter serve to separate these two species quite distinctly on these characters alone. The ratio of the width of the pronotum to the width of the base of the elytra is greater than the same ratio in *A. fisheri*. This form further differs from *A. fisheri* in having finely, shallowly, and sparsely placed punctures on the pronotum, while the latter has moderately fine, dense, and moderately shallow punctures. *A. vanduzeei* differs from both these in having coarse, deep, and dense punctuation. Elytral maculations and color serve to differentiate further these three closely allied species. In *A. nanbrownae* the maculations are vittate, *in A. fisheri vermiculata* less so and more broken, and in *A. vanduzeei* are completely broken up as in *A. labyrinthica*. The elytral color is straw-yellow and shiny black, while in the other two there are blue or green reflections, and the markings are either deep orange yellow and cupreous brown or both.

The writer takes pleasure in naming this species for Miss Nancie Brown of Carmel, Calif., and in acknowledging his indebtedness to the late Dr. Edwin C. Van Dyke for his aid and for the use of comparative material.

BOOK REVIEW

FRESH-WATER INVERTEBRATES OF THE UNITED STATES. By Robert W. Pennak. Ronald Press, New York, pp. ix+769, 470 figs. Price $14.00.

This long awaited work was published on April 8, 1953. Here, for the first time, a single author has brought together the basic taxonomic and biological information for our fresh-water invertebrates. Most of the keys are to genera. Illustrations are simplified and clear-cut. Bibliographies are up to date and seem to have been selected with excellent judgement. The book appears to be singularly free from typographical errors. The format is attractive and the typography is such that it is a pleasure to read the book.

The brief introduction is very interesting. In the discussion of barriers which have prevented most fresh-water invertebrates from invading the sea, it is stated that little is known but that the barriers are "perhaps chiefly osmoregulatory." Since several invertebrates inhabit inland waters of greater salinity than the ocean, the statement of Beadle (*Biol. Rev.*, 18:172–183, 1943) seems more plausible, i.e. that whatever the barriers may be they are certainly not osmoregulatory. For insects, at least, depth is an important barrier and competition is doubtless also a factor. The section on "Atypical Fresh-water Habitats" is entirely original and very stimulating. Tree holes,

pitcher plants and the bases of leaves of bromeliads might be added in a future edition.

The main part of the book is devoted, in succession, to each of the phyla, classes, and orders of aquatic invertebrates. Only the aquatic stages are included. This must have been a difficult decision and was no doubt forced upon the author because of the limitations imposed by present day printing costs and bulk. The insect chapters would be more usable if keys to adults could have been included.

The concluding pages are devoted to two appendices, one dealing with "Field and Laboratory Apparatus" and the other with "Reagents and Solutions." These sections are brief but include all essential information. A glossary would have been desirable but again would have added to an already bulky volume.

Probably no single reviewer will be in a position to evaluate Dr. Pennak's book in its entirety. I can only say that the chapter on Hemiptera, which I am able to review critically, is as complete as can be expected in a work of this kind and is accurate in all but a few insignificant details. For example, *Merregata* is not at all confined to the Midwest, Veliids are not all "ripple bugs"—only the genus *Rhagovelia* deserves this name, and *Rheumatobates rileyi* was described by Bergroth, not by Berg.

The appearance of this book is an important event in the development of limnology in the United States. No doubt it will stimulate teaching and research on fresh-water invertebrates for years to come and will be an essential part of the equipment of every aquatic biologist.—ROBERT L. USINGER.

BOOK REVIEW

INSECTS CLOSE UP. By Edward S. Ross. 81 pp., 125 figs. Univ. Calif. Press, Berkeley and Los Angeles. 1953. Price $1.50 (Cloth $2.25).

This book represents a milestone in the field of semi-technical entomological literature. The author has succeeded in combining factual knowledge with an extremely readable style. Each of the 47 sketches is concerned with an insect or a particular mode of insect life. Supplementing the written text are the superb, completely unposed, black and white and colored photographs of the subjects in their natural environment. The author, the Curator of Entomology at the California Academy of Sciences and a well known specialist in his own field, purposes to stimulate interest by demonstrating the tremendous diversity of insect life that can be uncovered by careful observation and patience. In this regard he succeeds exceedingly well for each page unfolds a fascinating phase of entomology.

The back of the book contains an illustrated section on the techniques of insect collecting showing various pieces of equipment and describing their use. The portion on the methods of preparing an insect collection is accompanied by a series of step by step diagrams clearly outlining the necessary procedures. Thus it essentially replaces the existing collecting manuals. In addition, the section on the techniques of insect photography will be a useful guide to those who wish to try this interesting and informative type of insect study.—JOHN D. LATTIN.

A NEW SPECIES OF THE GENUS ANGILIA FROM THE PHILIPPINES, WITH A CATALOGUE OF THE DESCRIBED SPECIES

(Hemiptera: Veliidae)

C. J. DRAKE[2] and H. HOBERLANDT[2]

The genus *Angilia* was erected by Carlos Stål (1865, p. 46) for the reception of *Velia albidocincta* Stål (1855, p. 46) from Kaffraria, Cape Colony Africa. Since then, seven other species and one variety have been described from Africa.

The present paper contains the description of a new species of *Angilia* from the Philippine Islands, and is the first record of the genus in the East Indies. The fine illustrations of the new species were made by Mrs. Ludvik Hoberlandt of Praha. In order to facilitate work in the group, a catalogue with bibliographic references and distributional records of the species is appended.

Angilia (Adriennella) philippiensis Drake and Hoberlandt

(Figure 1)

Macropterous Male: Rather broad, two and one-half times as long as wide. General color yellowish brown with some areas shaded darker; hemelytra chocolate brown with white markings. Dorsal surface with brownish or golden pubescence and also some very fine, rather short, erect, inconspicuous, brownish hairs. Legs pale testaceous with dark brown markings.

Size: Length, 4.25 mm.; width across humeral angles, 2.01-2.05 mm.

Head: Width across eyes, 1.10 mm. Head brown, paler beneath, very short, strongly deflexed in front of eyes and as seen from dorsal aspect with only about one-third of its length extending in front of anterior margins of the eyes; length of head and width of vertex equal (40:40). Eyes moderately large, semiglobular, excerted, dark brown or fuscous, shining. Rostrum pale brown with terminal segment blackish, reaching to apical third of mesosternum. Antennae (fig. 2) long ,slender, dark brown with basal segment lighter, shortly pilose, with some longer hairs on first segment; segment I moderately stout, considerably thicker than II, slightly bowed; II rather slender, a little thicker than next two; III and IV linear; formula—I, 61; II, 64; III, 85; IV, 72.

Thorax: Pronotum (figs. 1 & 3) very large, distinctly longer on median line than width across humeral angles (204:162), transversely convex between humeral angles, coarsely and irregularly pitted as may be seen in fig. 1, distinctly divided between humeral angles by a sharp wavy bicolor demarcation clearly separating anterior and posterior parts of pronotum; anterior part yellowish brown with both sides on anterior fifth somewhat darkened; median carina feebly represented, only on anterior fifth, the sides from humeral angles distinctly narrowed anteriorly and practically straight; front margin slightly

[1] Iowa State College, Ames, Iowa.
[2] Narodni Museum, Praha II, Czechoslovakia.

roundly emarginate, extending laterally scarcely beyond middle of the eyes; hind part dark brown, sharply narrowed posteriorly, somewhat triangularly in outline with sides slightly sinuate and apical part prolonged with apex blunt and rounded. Sternum dark fuscous brown, here and there toning into reddish brown. Plural dark fuscous brown with some bluish lustre.

Legs moderately stout, with hind femora a little stouter than in other pairs, testaceous with dark brown markings, clothed with short pubescence and longer hairs, the hairy vesture pale in the pale areas and dark in darkened areas; middle and hind femora as well as anterior tibiae moderately curved; coxae and trochanters pale in all legs. Anterior legs as in fig. 4; femora pale testaceous with apical third dark brown; tibiae testaceous with base; apex

Fig. 1. *Angilia (Adriennella) philippiensis*, dorsal aspect.

and a wide band near the middle dark brown, with apical comb composed of very small pegs and occupying half of the entire tibial length; tarsi dark brown, feebly paler at joints between segments; formula—femora, 120; tibiae, 122; tarsal segments, I, 6; II, 9; III, 30. Middle legs as in fig. 6; femora testaceous with apical part and a wide band just in front of middle dark brown; tibiae with a narrow basal part, a large band at middle and narrow apical part dark brown; tarsi very long, dark brown, the second segment basally and apically and the third basally somewhat testaceous; formula—femora, 148; tibiae, 149; tarsal segments, I, 15; II, 49; III, 46. Hind legs as in fig. 7; femora (also trochanters) armed beneath with numerous short dark teeth, similar in color and markings as in middle legs; formula—femora, 148; tibiae, 146; tarsal segments, I, 12; II, 15; III, 37.

Abdomen: Length as measured on outer margin of connexivum, 2.51 mm., tergites brown. Venter pale brown, strongly arched, space between segments

Figs. 2–11. *Angilia (Adriennella) philippiensis,* Fig 2, antenna; fig. 3, disc of pronotum (lateral aspect); fig. 4, front leg; fig. 5, middle leg; fig. 6, hind leg; fig. 7, eighth abdominal segment (dorsal aspect); fig. 9, anal conus; figs. 10 & 11, parameres (paratype).

and spiracles darkened, second and third tergites carinate on median line, fifth and sixth segments each with a shallow pit on median line, seventh tergite slightly depressed posteriorly, spiricles with some whitish tomentum, pubescence and longer hairs golden brown. Connexivum yellowish, posterior angles of seventh tergite brown; beneath with a pale reddish stripe running solidly from the second to the end of the seventh tergite. Eighth abdominal segment (fig. 7) somewhat cylindrical, slightly narrowed apically, laterally deeply notched, with long bristles on apical margin. Ninth abdominal segment (fig. 8) strongly widened towards the apex, the posterior margin broadly rounded. Parameres (figs. 10 and 11) similar in shape, apically and subapically narrowed, sinuate, with apex distinctly bent and markedly prolonged on inner side; lower part, middle and apical parts with bristles.

Hemelytra reaching to apex of abdomen, chocolate brown with veins darker, an elongate spot in basal exterior cell, a small oval spot in middle cell, a very large spot (constricted near the middle) in apical part of membrane, and sometimes a small irregular spot on each side of the latter white. Veins and membrane of cells sparsely clothed with short appressed golden pubescence.

Holotype (macropterous male), SAN JOSE, MINDORO, PHILIPPINE ISLANDS, March, 1945, collected by F. S. Skinner; in the California Academy of Sciences. *Paratype* (macropterous male), same locality as type, April, 1945, E. S. Ross. Units of measure employed in the description may be converted into millimeters by dividing by 80.

Differs from A. *(Adriennella) schoutendeni* Poisson by the distinctly less arched disc of pronotum, lateral notches on the eighth abdominal segment of the male and differently formed parameres. Size and coloration of the two species are also quite different.

CATALOGUE OF THE DESCRIBED SPECIES OF ANGILIA

Genus *Angilia Stål*, 1855

Type, *Velia albidocincta* Stål, 1855

1865. *Angelia* Stål, Hem. Afr., 3:167.

1942. *Angilia* Poisson, Rev. Zool. Bot. Afr., 36 (2): 154.

Subgenus *Angilia* Poisson, 1942

Type, *Velia albidocincta* Stål, 1855

1. **Angilia aeterna** Hoberlandt

1946. *Angilia aeterna* Hoberlandt, Acta Soc. Ent. Cechosl., 43 (1–2): 55–58, figs. 1–2.

1951. *Angilia aeterna* Hoberlandt, Bul. Inst. Fr. Afr. noire, 13 (4): 1131. DISTRIBUTION: South Sahara, Dahomey.

2. **Angilia albidocincta** (Stål)

1855. *Velia albidocincta* Stål, Ofv. Vet. Ak. Forh., 1:46.

1865. *Angilia albidocincta* Stål, Hem. Afr., 3:46.

1942. *Angilia albidocincta* Poisson, Rev. Zool. Bot. Afr., 36 (2): 154–157, figs. 6–9.

Distribution: Cape Colony (Kaffraria), Uganda, South Ethiopia, Ivory Coast.

3. **Angilia congoensis** Poisson

1950. *Angilia congoensis* Poisson, Rev. Zool. Bot. Afr., 43 (1–2): 82–83, fig. 16.

Distribution: Belgian Congo (Boma).

4. **Angilia dubia** Poisson

1942. *Angilia dubia* Poisson, Rev. Zool. Bot. Afr., 36 (2): 157–159, figs. 10–12..

Distribution: Belgian Congo (Elisabethville).

5. **Angilia kenyalis** Poisson

1950. *Angilia kenyalis* Poisson, Rev. Zool. Bot. Afr., 43 (1–2): 81–82, fig. 15.

Distribution: Kenya.

Subgenus *Adriennella* Poisson, 1942

Type, *A. Andriennella* Poisson, 1942

6. **Angilia conradsi** Poisson

1950. *Angilia conradsi* Poisson, Revfl Zool. Bot. Afr., 43 (1–2): 83, fig. 17.

Distribution: Belgian Congo (Victoria Nyanza).

7. **Angilia perplexa** Poisson

1950. *Angilia perplexa* Poisson, Rev. Zool. Bot. Afr., 36 (2): 159–161, figs. 13–15.

Distribution: Belgian Congo (Lembo).

8. **Angilia philippiensis** Drake and Hoberlandt

1953. *Angilia philippiensis* Drake and Hoberlandt, Pan-Pacific Ent., 29 (4): 223–227, figs. 1–11.

Distribution: Philippine Islands (Mindoro).

9. **Angilia schoutedeni** Poisson

1942. *Angilia schoutedeni* Poisson, Rev. Zool. Bot. Afr., 36 (2): 161–164, figs. 16–19.

Distribution: Belgian Congo (Lembo, Leopoldville).

9a. **A. schoutedeni** *form* **camelus** Poisson

1950. *Angilia schoutedeni f. camelus* Poisson, Rev. Zool. Bot. Afr., 43 (1–2): 84, fig. 19.

Distribution: French Congo (Lambarene).

Errata: The following should be inserted at the foot of page 121 (vol. 29) of the preceding issue, in Dr. Gressitt's description of the genus *Neodownesia*. Prothorax slightly broader than long, arched anteriorly, parallel-sided, distinctly margined laterally; densely and deeply sculptured. Scutellum longer than broad, narrowed apically. Elytra long, slightly broader than prothorax basally, widened in middle, narrowed and rounded apically; each elytron with three raised costae, two rows of punctures in each of first three interstices and three or four rows in last. Intercoxal process of prosternum large, somewhat swollen; intercoxal process of mesosternum meeting metasternum at midpoint of middle coxae. Femora short and stout; tarsi broad, as long as tibiae.

BOOK REVIEW

METHODS AND PRINCIPLES OF SYSTEMATIC ZOOLOGY. By Ernst Mayr, E. Gorton Linsley, and Robert L. Usinger. McGraw-Hill Book Co., New York, Toronto, London. ix+328 pp. 1953.

This book fills an important need for a work on the principles of systematics as it should be practiced in zoological sciences. (The authors apply the word taxonomy in a broad sense, not making the common distinction between taxonomy and systematics.) The book is well written and interesting, although to the taxonomically sophisticated there may seem to be too much emphasis on purely mechanical details. However, in view of the confusion which has often resulted from poor taxonomic practices, these details are doubtless warranted and should be particularly valuable to those entering the taxonomic field for the first time.

The authors, an ornithologist and two entomologists, advocate the view that "it is less the findings of taxonomy than its principles and methods which need to be taught". They feel that taxonomy should not be an end in itself but is an important branch of biology whose objectives go far beyond mere identification and classification; taxonomy should contribute to other zoological fields, especially to those relating to that central problem of biology, the mechanism of evolution.

Considering this healthy approach it has been a surprise to some that the basic principles of speciation and phylogeny are treated only briefly or with the assumption that the details are known to the reader or can be learned elsewhere by him. This procedure seems justified, however, in view of the several books devoted to these principles and the absence of any previous modern account of the mechanics of taxonomy. The book, then, is devoted very largely to methods, the three parts being: "Taxonomic categories and concepts" (60 pages), "Taxonomic procedure" (137 pages), and "Zoological nomenclature" (84 pages).

The discussion of zoological nomenclature is particularly good. In view of recent controversies in this field it should be pointed out that this discussion presents the various viewpoints in a thoroughly tempered manner and is a real contribution to the general understanding of some of the most pressing nomenclatural problems.

A shortcoming of the book is its failure to place strong emphasis, for the guidance of those entering the field, on the types of systematic problems which are usually most profitable: studies of species or limited groups over their entire range or over as broad a part of their range as practical, *not* faunal studies of taxonomically large groups in limited areas. It should be pointed out that the chapter on quantitative methods of analysis does not nearly exhaust the possible uses of biometry in the solution of problems related to systematics. The defects are minor, however, and we have here a book which will be a useful part of the library of any systematist and a valuable text for courses in the principles of systematics. It is hoped that, with the aid of this work, more courses will be offered on systematic principles and fewer on the taxonomy of particular groups such as the Hymenoptera, the Coleoptera, or the birds and mammals.—CHARLES D. MICHENER.

Acarina, 198
Acmaeodera **bryanti**, 104
nanbrownae, 219
Aedes nigromaculis, 63
Agonita **picea**, 124
sculpturata, 125
Aleochara ponderosa, 164
Allorhagium, 207
Ambrysus hungerfordi **spicatus**, 138
dyticus, 140
Angilia aeterna, 226
albidocincta, 226
congoensis, 227
dubia, 227
kenyalis, 227
conradsi, 227
perplexa, 227
philippiensis, 223
schoutedeni, 227
schoutedeni form camelus, 227
Anthonomus, 41
peninsularis, 41
pervilis, 41
Antrodiaetus pacificus, 205
Apatophysis, 207
Aphidae, 1, 17, 43, 127, 147
Aphidologists, 2
Collecting, 10
Collections, 12
Distribution, 7
Importance, 5
Life Histories, 8
Literature, 12, 147
Nomenclature, 147
Arachnida, 203
Aranea gemmoides, 206
Araneida, 205
Argasidae, 198
Asilidae, 25
Barr, Orthezia, 210
Belonuchus sp. nr. punctiventris, 164
Biological control, 112
Bombidae, 144
Bombus sonorus, 144
Brachicoma sarcophagina, 144
Brachycistis sp. nr. furtivus, 63
Brumus parvicollis, 210
Buprestidae, 34, 104, 176, 219
Calliphoridae, 145
Callispa angusta, 121
donckieri, 121
ruficollis, 121
Calospasta **edmundsi**, 48
Cantharidae, 170
Carabidae, 98, 102
Carcinops sp., 164
Cassidispa bipuncticollis, 126
Cecidomyia *flosculorum*, 129
Cediopsylla inaequalis inaequalis, 39
Centrodera, 207
Cephalcia **marginata**, 133
Cerambycidae, 14, 207
Ceratophyllus celsus, 40
Chelinidea tabulata, 164
Chilocorus bipustulatus, 62
Chrysobothris **yucatanensis**, 104
Chrysomelidae, 121
Cicadidae, 191
Clidophleps distanti, 195
distanti, var. pallida, 195
Clubiona norvegica, 205
trivialus, 205
Coleomyia, 25, intraspecific variation, 29
alticola, 28, 29, 34
crumborum, 25, 29, 34
hinei, 28, 29, 34
rainieri, 28, 29, 34
rubida, 27, 28, 29
sculleni, 29, 32
setiger, 28, 29, 30
Coleoptera, 14, 34, 41, 47, 98, 121, 127, 163, 170, 176, 203, 207, 218, 219
Colias, 67
Collecting in National Parks, 109
Collinsia ksenia, 206
Colpodes buchanani, 134
sargentorum, 134
Conicera atra, 146
Conopidae, 146
Cryptochia **furcata**, 166
Cryptostomatidae, 67
Ctenocephalides canis, 38
felis, 38
Culicoides copiosus, 164
spinosus, 46
Curculionidae, 101, 105, 107
Cuterebra latifrons, 155
Cuterebridae, 155
Cynaeus angustus, 164
Dactylispa approximata, 125
chinensis, 125
crassicuspis, 125
excisa repanda, 126
platyacantha, 126
sinuispina, 126
Danaidae, 112
Danaus menippe, 112

*New names in bold face, synonyms and homonyms in italics.

Dasineura **gentneri**, 131
leguminicola, 129
Dasyhelea mutabilis, 164
Dasymutilla paranocturna, 63
phoenix, 63
Day, Ephemeroptera, 25
Denning, Limnephilidae, 165
Dermaptera, 163
Desmometopa sp. (?tarsalis), 163
Diamanus montanus, 40
Diceropracta apache, 195
apache, var. ochrarleuca, 195
Dicladispa armigera similis, 126
Dinocleus **bryanti**, 101
Diplochaetus **desertus**, 98
Diptera, 25, 46, 49, 60, 64, 65, 144, 155, 163, 181, 182, 208, 210, 213
Dixidae, 181
Drake & Hoberlandt, Angilia, 223
Drapetes **parallelus**, 100
Dromaeolus **peninsularis**, 103
Drosophila sp., 163
Drosophilidae, 163
Dysticheus **rotundicollis**, 106
Echidnophaga gallinacea, 37, 42
Edmundsius, 19, **agilis**, 22
Empididae, 190
Ephemeroptera, 19
Epimelitta aureopilis, 16
Erigone metlakatla, 206
whymperi, 206
Erycia **picata**, 58
sectilis, 59
Essig, Aphid Miscellany, 1
Essig, Israeli aphid, 127
Essig, Orchard grass aphid, 17
Essig, Van Dyke, 73
Eumacronychia **scitula**, 50
Euphyto **ruficeps**, 49
Fabriciella **evanida**, 53
invelata, 51
plumasana, 53
Fender, Podabrus, 170
Figg-Hoblyn, Acmaeodera, 219
Fisher, Rhinotragini, 14
Foxella ignota omissa, 40
Gerridae, 178
Gressitt, Lepturinae, 207
Gressitt, Hispine beetles, 121
Gilbert, Anthonomus, 41
Gillogly, Trichogramma minutum in Monarch butterfly eggs, 111
Heleidae, 46, 164
Heleomyzidae, 60
Helfer, New Hippomelas, 34
Helfer, Trachykele, 176
Hemiptera, 67, 138, 143, 178, 199 223
Hilarella hilarella, 213
Hippomelas
insularis, 34, 36
insularis castanea, 36
Hispellinus moestus, 125
Histeridae, 164
Homoptera, 1, 17, 43, 127, 147, 191, 210
Hoplopsyllus
affinis, 38
anomalus, 39, 42
Hololepta yucateca, 164
Hottes, Aphidological gleanings, 147
Hottes, Myzocallis, 43
Hoyt, Musca domestica, 208
Hubert, Paradixa, 181
Hubert, Rhamphomyia, 190
Hyalopteroides humilis, 17
pallida, 18
Hymenoptera, 63, 111, 133, 144, 157, 211
Hystrichopsylia dippiei, 135
Imania **chama**, 168
Ischnura, 69
Israelaphis, 127, **carmini**, 128
Itonididae, 128
Khalaf, Culicoides spinosus, 46
Labiidae, 164
La Rivers, Guatemala Ambrysus, 138
Leech, Van Dyke Bibliography, 89
Lepidoptera, 67, 69, 111, 201
Leptispa godwini, 121
Leptometopa latipes, 60
Leptyphantes, 206
Leuronychus pacificus, 206
Ligyrus gibbosus, 63
Limnephilidae, 165
Linyphia digna, 206
Lonchaea striatifrons, 163
Lonchaeidae, 163
Loomis, Otobius, 198
Macrancylus **franciscanus**, 108
Malkin, Arachnida, 205
Malkin, Oxyporus, 218
Malkin & Hatch, Colpodes, 134
Martin, Coleomyia, 25
Megaselia sp. 146
Melasidae, 103
Meledonus **lindensis**, 57
Meloidae, 47
Mericia **cobala**, 55
hamilla, 54
Metellina curtisi, 206
Metrobates trux **infuscatus**, 179

Middlekauff, pine sawfly, 133
Milichiidae, 60, 163
Misumene vatia, 205
Monopsyllus wagneri kylei, 40
Muscidae, 60, 208
Muscina stabulans, 60
Muscoidea, 49
Myodopsylla collinsi, 41
Myzocallis californicus, 43
  mauereri, 43
  tonkawa, 45
Naucoridae, 138
Nebria **raveni**, 102
Nemocestes **fragariae**, 105
Neodownesia, 121, rubra, 122
Neossos marylandica, 60
Nymphalis californica, 201
Odonata, 69
Odontocera
  meridanus, 14
  planitibialis, 15
Odontopsyllus dentatus, 40
Okanagana arboraria, 195
  arboraria, var. crocea, 195
  davisi, 191
  pallidula, 196
  rubrovenosa, 195
  triangulata, 195
  triangulata, var. crocina, 195
  vanduzeei, 195
  vanduzeei, var. californica, 196
  vanduzeei, var. consobrina, 196
Okanagodes gracilis, 195
  gracilis, var. pallida, 195
Ophiogomphus, 69
Opisocrostis hirsutus, 40
Opisodasys robustus, 39
Orchopeas howardi, 39
  sexdentatus, 42
  sexdentatus neotomae, 39
  sexdentatus schisintus, 39
Orthezia annae, 210
Oxymirus, 207
Oxyporus mexicanus, 218
  quinquemaculatus, 218
Pacific Coast Ent. Soc., 61
  Field trip, 66
  Proceedings, 61
Pamphiliidae, 133
Paradixa californica, 181
Paratriatoma hirsuta, 199
Pardosa metlakatla, 205
Passalidae, 203
Passalus **dominicanus**, 204
Paxillus schneideri, 203
Pepsis, 61
Phalangida, 205
Phalangium opilio, 206
Philotes rita, 69
Phoridae, 146
Psysocephala sp., 146
Pilyohyphantes rubrofasciatus, 206
Platypedia **bernardoensis**, 195
  middlekauffi, 194
  putnami, 194
  sylvesteri, 192
  usingeri, 192
Platypria fenestrata, 126
Podabrus, **alexanderi**, 175
  edmundsae, 170
  ochocensis, 174
  pineatus, 172
  piniphilus, 173
Popilius lenzi, 203
  tenuis, 203
Pritchard, flower midges, 128
Pseudomorpha **alleni**, 99
  peninsularis, 99
Pseudopachyta, 207
Pulex irritans, 38, 42
Radema **tavala**, 169
Reduviidae, 199
Reinhard, western muscoids, 49
Rhagium, 207
Rhamphomyia argenteus, 190
Rossiana, 165, **montana**, 166
Ryckman, Cuterebra latifrons, 155
Ryckman, Diptera reared from barn owl nests, 60
Ryckman, parasites of Bombus sonorus, 144
Ryckman, Paratriatoma, 199
Ryckman, Typanosoma cruzi, 143
Ryckman & Ames, Adoxomyia, 60
Ryckman & Ames, cacti insects, 163
Sachalinobia, 207
  rugipennis koltzei, 207
  rugipennis rugipennis, 207
Sarcophaga litorosa, 146
  morionella, 146
  tuberosa sarracenioides, 146
Sarcophagidae, 146, 213
Selander, Utah Calospasta, 47
Simons, Calif. Cicadas, 191
Siphonaptera, 37, 42, 135
Sitticus palustris, 206
Solierella albipes, 162
  australis, 162
  blaisdelli, 160
  boharti, 157
  clypeata, 160
  corizi, 160
  inermis, 160
  lasseni, 157

major, 158
peckhami, 160
sayi, 162
similis, 159
sonorae, 157
striatipes, 159
vandykei, 159
vierecki, 159
Sphaeroceridae, 163
Sphecidae, 157, 211
Spongovostox apicedentatus, 164
Staphylinidae, 164, 218
Stark, Hystrichopsylia anomaly, 135
Stenistomera alpina, 40
Stenocorus, 207
Stilomedon, 164
Stratiomyidae, 60
Syrphidae, 163
Tachinidae, 49
Tachinisca cyaneiventris, 69
Tachiniscidae, 69
Tanypteryx, 69
Tenebrionidae, 164
Tevis, Nymphalis, 201
Thrassis arizonensis arizonensis, 39, 42
pansus, 40
setosis, 40, 42
Throscidae, 100
Tilden, Ammophila saeva, 211
Tohm, Arizona fleas, 42
Toxotus, 207
Trachykele blondeli **cupreomarginata**, 176
Triatoma rubida, 143
Trichogramma minutum, 111
Trichogrammatidae, 111
Trichoptera, 165
Trypanosoma cruzi, 143
Usinger, Metrobates, 179
Van Doesburg, Passalidae, 203
Van Dyke, Edwin Cooper, 73
Bibliography, 89
Van Dyke, New Coleoptera, 98, 102
Van Dyke, New Cossonid, 107
Veliidae, 223
Volucella apicifera, 163
esuriens, 163
isabellina, 163
Wehrle, Arizona fleas, 37
Williams, Solierella, 157
Xanthopygus cacti, 164
Xysticus pretiosus, 205
Zenillia **scolex**, 56